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THE NATIONAL GEOGRAPHIC MAGAZINE

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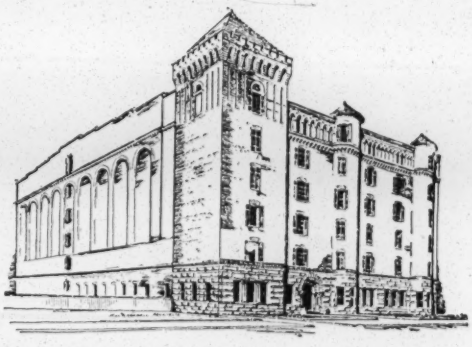

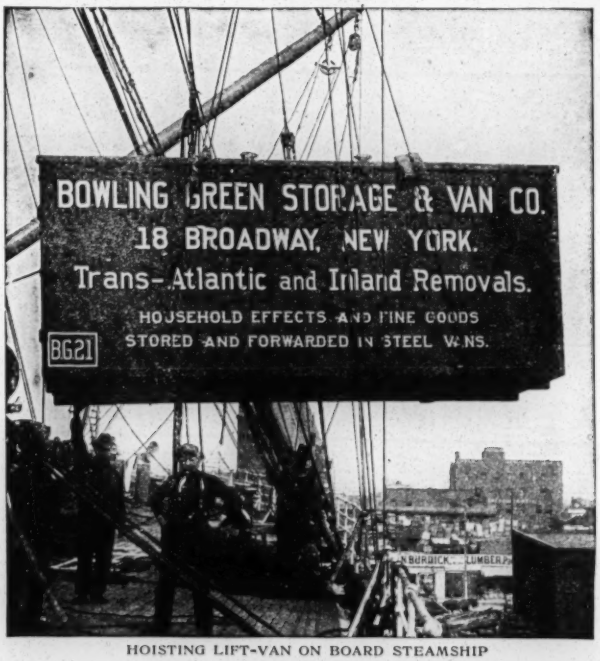
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THE NATIONAL GEOGRAPHIC MAGAZINE

THE POLICEMEN OF THE AIR

An Account of the Biological Survey of the Department of Agriculture

BY HENRY WETHERBEE HENSHAW

THE pursuit of science solely for its own sake, however commendable it may be, is not the spirit that animates our government in its support of scientific research. In its aims and ambitions this is a practical age. Thousands of men are experimenting, inventing, and prying into the secrets of nature for the avowed purpose of utilizing their discoveries for the practical benefit of mankind. Applied science has come to occupy a very important place in our government institutions, and in none is it more important than in the Department of Agriculture.

From small beginnings, the department in little less than half a century has expanded in every direction, and in the last decade, under the able management of Secretary Wilson, has grown to huge proportions. Its work is divided among numerous bureaus, each with a distinct line of research, and a small army of assistants is employed, many of whom are engaged in various fields of scientific investigation for the benefit of the American farmer.

It is the work of one of its bureaus, the Biological Survey, that concerns us here. The Survey had its beginning in 1885, when its present head, Doctor C. Hart Merriam, with one assistant, began to investigate the economic relations of birds to agriculture. The scope of the field was soon enlarged to include the kindred subject of economic mammalogy. In addition to these important subjects, its duties now include the study of the geographic distribution of animals and plants with special reference to the determination of life and crop zones, and the supervision of matters relating to game protection and the importation of foreign birds and animals.

RELATION OF BIRDS TO AGRICULTURE

When the Survey began its work very few accurate observations on the food of birds had been recorded. Most of the published information bearing on the subject rested on field observation only, and, besides the liability to error from faulty or insufficient observations, the data gathered in this way were entirely inadequate. It is not enough to be told that birds feed on insects; we must know the particular kinds they eat. The fact that the crow sometimes eats corn is not sufficient evidence upon which to condemn

From the Biological Survey

FOUR COMMON SEED-EATING BIRDS

1, Junco; 2, White-throated Sparrow; 3, Fox Sparrow; 4, Tree Sparrow

the bird. We must learn the nature of its food at all times of year, and then strike a fair balance between its good and its bad deeds; hence the absolute necessity for the examination of the contents of birds' stomachs, by which means may be accurately determined not only the kinds of food eaten but their relative quantities. This method is exceedingly slow and laborious, requqires a high order of expert ability, and moreover is open to the very serious objection that it necessitates the taking of useful lives. So far as possible, the latter objection has been minimized by utilizing the stomachs of birds killed by naturalists for scientific purposes. This material, which otherwise would be lost to economic science, renders it unnecessary, except in special cases to destroy birds for the purpose of food examinations.

From the Biological Survey

SPARROW HAWK

Which helps the farmer by eating grasshoppers, crickets, and beetles (see page 85)

In the above connection it must not be forgotten that when a thorough examination of the food of a given species is once made and the results published, the work is done for all time. The food habits of a species having been once determined by this method, no possible excuse exists, so far as food investigations go, for further destruction of bird life; and the more so because the contents of all stomachs examined are preserved as vouchers for further verification, should that be deemed necessary.

Passing to a consideration of some of the practical problems presented, it might seem that the relation of birds to agriculture were simple, since the question is chiefly one of food. Do birds destroy crops? then of course they are injurious. Do they eat insects? then of a certainty they must be beneficial. But the problems are not to be settled in this off-hand fashion. In reality they are extremely complex and are to be understood only after much painstaking study. It has been found, for instance, that a bird may be injurious at one time and not another. In one region it may be a pest and in another an unmixed blessing. Some birds—unfortunately not many—are always beneficial. Others—fortunately not many—are always and everywhere injurious. But the great bulk of birds are both harmful and beneficial by turns, according to age, season of the year, the presence or absence of their natural food, and a variety of circumstances.

THE TREE SPARROWS VERY BENEFICIAL

For present purposes we may roughly group the bulk of our small birds into two classes — seed-eaters and insect-eaters. The seed-eaters, mostly of the sparrow family, have stout bodies and strong conical bills, expressly designed for crushing seeds. Their name is legion and the

From the Biological Survey

A USEFUL BIRD OF PREY

Swainson hawk. This bird saves the western farmer $100,000 a year (see page 85)

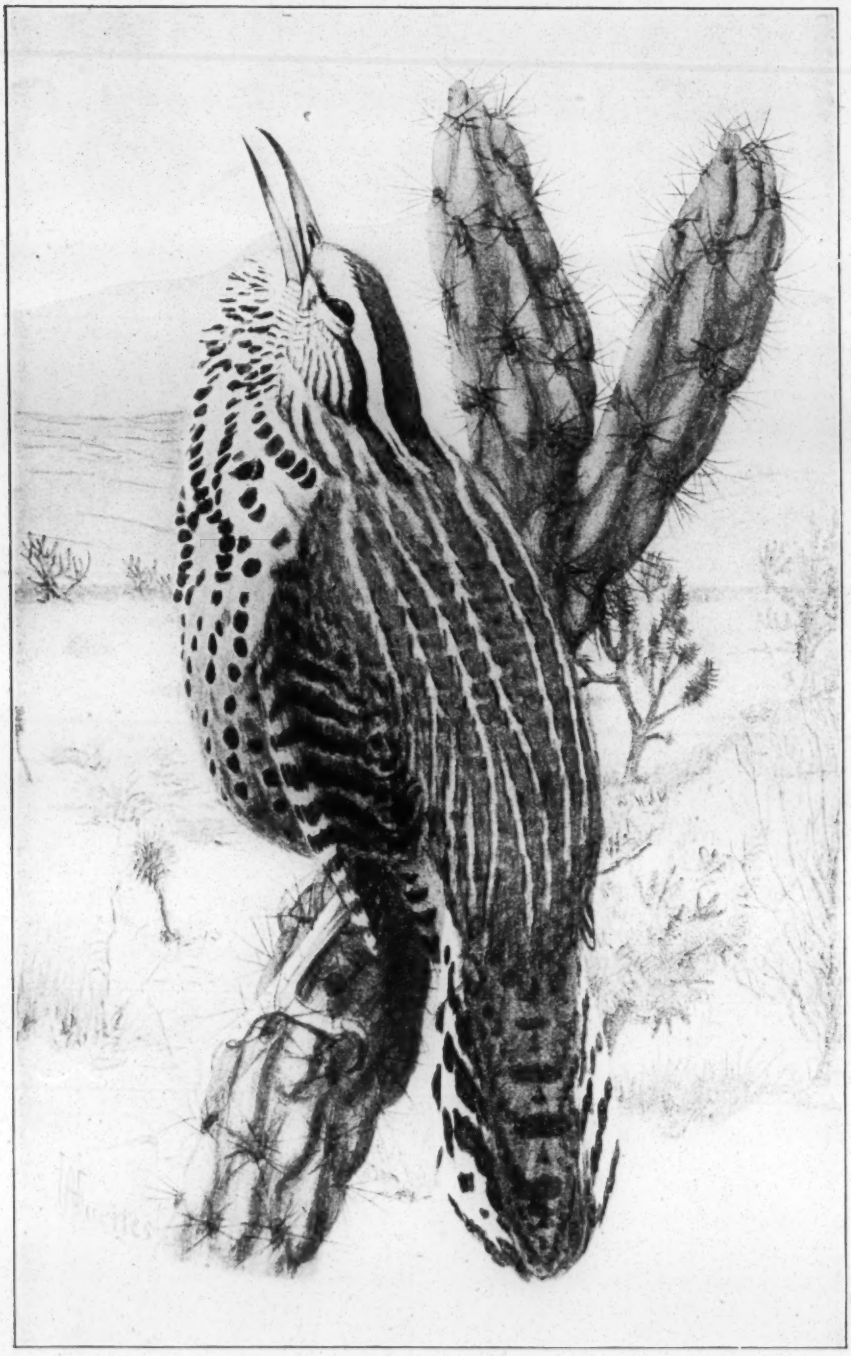
family contains more species than any other group of birds. It is well that this is so, for the destruction of weed seed is of tremendous importance to the farmer, whose trouble to keep ahead of the weeds, great as it is now, would be vastly increased were it not for the soberly clad and unobstrusive little sparrows. We may get an idea of the value of the service these birds render by noting what is done for the farmer by the tree-sparrow, one of the most confirmed seed-eaters of the group. A quarter of an ounce of seed per day is a safe estimate of the food of an adult tree-sparrow. On this reckoning, in a state like Iowa, where agriculture is relatively very important, tree-sparrows annually eat about 875 tons of weed seed:

The total value of the principal field crops of the United States for the year 1906 was about $3,500,000,000. If we estimate that the combined consumption of weed seed by the sparrow family results in an annual saving of only 1 per cent of the value of the crops, the sum total saved to the farmer in 1906 was $35,000,000.

Though seeds form the chief part of the subsistence of sparrows, the destruction of seeds is by no means all we have to thank these birds for. They eat many insects also, and seem to know instinctively that while seeds are excellent food for adult birds, they are not necessarily good for nestlings, and hence feed the latter almost exclusively on insects.

Sparrows, however, are not the only birds that consume the seeds of weeds. The eastern quail or bobwhite is a confirmed eater of weed seeds. Highly exteemed as bobwhite is by the epicure for food and by the sportsman as an object of pursuit, he is probably worth so much more as a weed-destroyer that the farmer can ill afford to have him shot, even though the privilege is roundly paid for. A bevy or two of quail on a farm is an asset the value of which no thrifty farmer should overlook. Doves also are seed eaters, especially the turtle-dove, whose crop often is so packed with the seeds of weeds that it can hold no more.

The farmer has no quarrel with birds that confine their attention to grass and weed seeds, and welcomes their presence always and everywhere. There are birds, however, which eat such seeds as corn, wheat, and barley, and whose place in the farmer's esteem is by no means so well assured—the crow and the blackbirds for instance. There are several kinds of blackbirds which at times attack crops as also does the crow. The destruction by the crow of meadow mice, and of cutworms and other insect pests and the destruction of many kinds of insects by the blackbirds, however, are considered in most localities to offset all damage done in other ways and even to leave a balance in favor of the birds.



From the Biological Survey

CACTUS WREN

A common desert bird of the southwestern United States

From the Biological Survey

GOLDEN EAGLE

The most widely distributed of the eagles. It ranges over most of North America and a large part of the old world. In sections of California the Golden Eagle feeds on ground squirrels and is wholly beneficial, while in some other parts of its range it feeds on lambs and wild game and is a noxious species.

BIRDS THAT EAT INSECTS

Many birds, as flycatchers, warblers, swallows, and chimney-swifts, live exclusively, or almost so, on insects, and very many more, as blackbirds, orioles, and some hawks, depend on them for a considerable part of their livelihood. The little sparrow-hawk lives very largely upon grasshoppers, crickets, and beetles, and even one of the larger hawks—the Swainson hawk of the western plains—at certain seasons destroys enough of these injurious insects, together with small rodents, to save the western farmer upwards of a hundred thousand dollars a year.

From the Biological Survey

A BARRED OWL

If all insects preyed upon vegetation, our inquiry into the value of insect-eating birds need go no further, since all of them might be set down as beneficial; but by no means all insects are destructive of vegetation, and their relations to each other and to birds are very complex and puzzling. The insects that feed on vegetation at some stage or other of their existence probably outnumber all others, both in number of species and of individuals; but there are two other classes of insects which deserve attention here, the predaceous and the parasitic. The predaceous insects, either in the adult or larval state, feed upon other insects and hence in the main are beneficial. It would seem, therefore, that in so far as birds destroy predaceous insects they do harm. That birds do destroy a greater or less number cannot be denied, but as many species of this group secrete nauseous fluids, which serve, in a measure at least, to protect them, and as many are of retiring habits and not readily found, the number destroyed by birds is relatively not large. Moreover, some of the predaceous insects, when insect food is not available, become vegetarians, and hence assume the role of enemies of the farmer; so that when birds destroy predaceous insects they may be doing the farmer either a good turn or an ill turn, according to circumstances.

The relation of birds to the so-called parasitic insects is still more intricate and puzzling. Parasitic insects fill a very important place in the economy of nature; it is even claimed by entomologists that they do more effective service in aiding to keep true the balance in the insect world than any other agency. They attack insects in every stage of existence and insure their destruction by depositing eggs on, or in, the bodies of adults, their larvæ (the worm or caterpillar stage), their pupæ, or their eggs. Now, birds recognize no fine distinctions in the insect world. All is grist that comes to the avian mill, and parasitic insects are snapped up by birds without the slightest regard to the fact that they are useful to man. Hence we have a complicated problem to unravel in respect to the interrelation of insect pests, of insect parasites that destroy them, and of birds that destroy both pests and their parasites. As Swift phrases it:

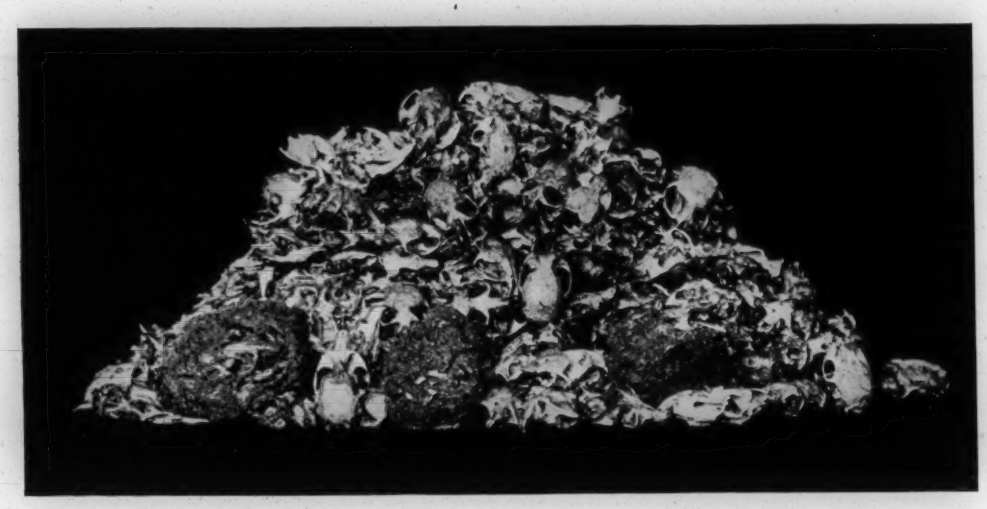


Photo from the Biological Survey

A MONUMENT TO THE INDUSTRY OF BARN OWLS

Field Mouse skulls found under owl roost in Smithsonian tower, Washington (see page 87)

So, naturalists observe, a flea
Has smaller fleas that on him prey;
And these have smaller still to bite 'em,
And so proceed *ad infinitum*.

After due recognition of the part insect parasites play in the economy of nature, it is evident that, unassisted, they are unequal to the task of keeping insect life in a proper state of equilibrium. In this work birds play an important, though it may be relatively a somewhat subordinate part. Had parasitic and predaceous insects been equal to the task of holding in check insect pests, there would be no place in the world for insect-eating birds. In the progress of evolution, however, long after insects and insect parasites appeared, birds found a place vacant, which even their reptilian ancestors had not been able to occupy, and proceeded to fill it. Having once gained a place in the world, birds entered into a competitive struggle with each other and with other insect-eaters. In the course of time they developed into a great number of families, each distinguished by peculiarities of form, plumage, and habits, and each endowed with methods of its own in the pursuit of food. That so many birds are insect-eaters is an index alike of the enormous reproductive capacity of insects and the inadequacy of the forces that warred on insects before the advent of birds.

HAWKS AND OWLS ARE NOT MARAUDERS BUT MOST BENEFICIAL

The popular idea regarding hawks and owls is that they are nothing but robbers and bold marauders. Their real character and the nature of their services to man are generally overlooked. The fact is that the great majority of our hawks and owls are beneficial, and spend the greater part of their lives in killing small rodents, most of which are always and everywhere noxious. Hawks and owls are long-lived birds, as birds go, and this fact gives a hint of their importance in the eyes of nature and of their value as servants of man.

The work of hawks and owls is complementary. All hawks are diurnal, and hunt their prey between the hours of daylight and dark. Owls, on the contrary, are chiefly nocturnal, but do much of their hunting in the early evening and morning hours, or by moonlight, and when pressed by hunger or when feeding young, they sometimes hunt by day. Hence, between them, hawks and owls

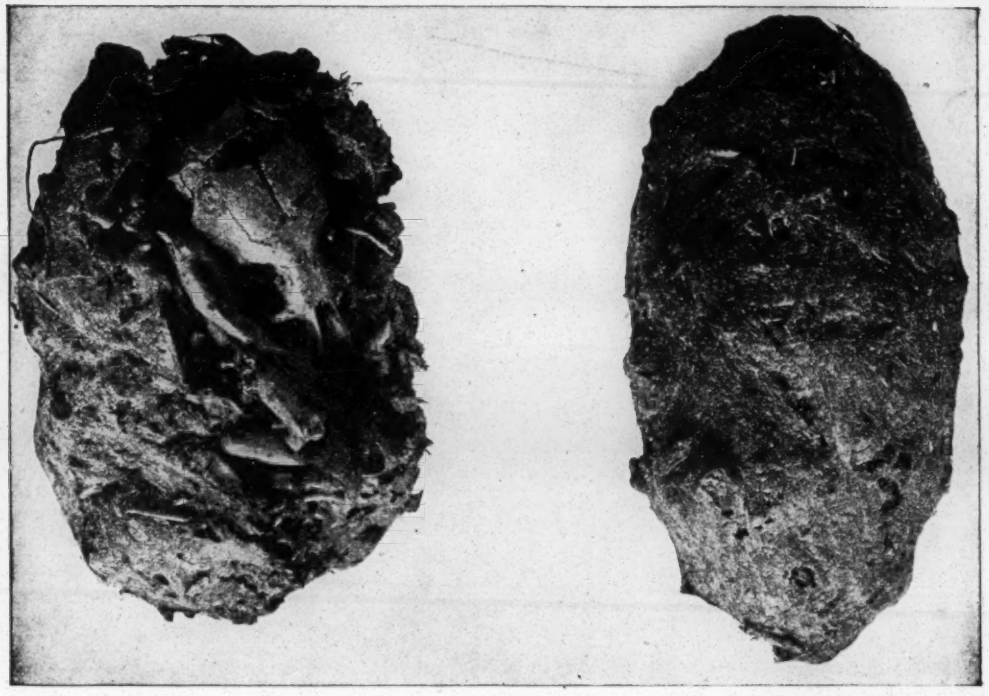


Photo from the Biological Survey

PELLETS THROWN UP BY OWLS, CONTAINING BONES AND HAIR OF MICE, NATURAL SIZE

are on duty throughout the 24 hours, and thus are enabled to prey on all kinds of rodents, large and small, those which are abroad by night as well as those active by day.

The bulk of the depredations on birds and chickens due to hawks is committed by three species—the Cooper and sharp-shinned hawks and the goshawk; and the sportsman and farmer's boy should learn to know these daring robbers by sight, so as to kill them whenever possible. The so-called "hen-hawks," usually either the red-shouldered or red-tail hawk, are too often made victims of a bad name; for while both species occasionally snatch a chicken, the habit is far too uncommon to justify the name "hen-hawk." The good these two big hawks do in the long run by destroying rats and mice far more than compensates the farmer for the insignificant damage he suffers at their talons.

CURIOUS METHODS OF DIGESTION

Both hawks and owls often swallow their prey entire or in large fragments, together with the bones, hair, and even some of the feathers. Avian digestion is both good and rapid, but it is unequal to the task of assimilating such substances, and accordingly both hawks and owls throw up these rejecta in the form of neatly rolled pellets. In studying the food habits of birds of prey much use is made of these pellets, and the vicinity of a nest of a pair of horned owls, for instance, often contains an unmistakable record of the birds' food, and perhaps that of the young, for months or even years.

From the foregoing it will at once appear that the practice of offering bounties indiscriminately for the heads of hawks and owls, as has been done by some states, is a mistake, and results not only

in the wasting of public funds, but in the destruction of valuable lives, which can be replaced, if at all, only with great difficulty and after the lapse of a term of years. In no one particular does the public, especially the sportsman and farmer, need to be educated more than in the value of hawks. The temptation to shoot a hawk or owl, perching or flying, is well nigh irresistible, and the bad habit is having the natural result of so reducing the numbers of these birds as to make it impossible for the survivors to do the work nature intended them to do. The notable increase of noxious rodents in the last decade in certain parts of the United States and the resulting damage to crops without doubt are due in no small part to the destruction of their natural enemies, chief of which are the birds of prey.

When the public is fully informed as to the value of hawks and owls and an enlightened sentiment is exerted in their behalf, they will increase in numbers and the damage to crops from noxious mammals will correspondingly diminish.

From the Biological Survey

THREE-TOED WOODPECKER
A conservator of the northern forests

THE POLICEMEN OF THE AIR

Differing widely as they do in structure and habits, birds collectively are able in man's interests to police earth, air, and water. The thrushes and other ground feeders scour the surface of the earth and hunt under leaves for hidden insects. The warblers, titmice, nuthatches, creepers, and others search among the foliage and in the crevices of bark for all manner of creeping things. The woodpeckers, a highly specialized group, perform a service no other birds are equal to, since with their specially designed chisels they dig into wood and drag forth the hidden larvæ that prey on our forest monarchs. The flycatchers from their perches dash out for their prey as it flies from bush to bush or tree to tree, while the swallows and swifts skim the air, and with intricate evolutions snap up such insects as have escaped the active search of their brethren nearer earth. The waters too and their shores have their feathered denizens which exact special tribute of the insect world.

So that, quite aside from questions of sentiment, birds must be adjudged to play an active and important part in keeping nature's balance true. Their role is all the more important, since no other creatures are fitted for their special duties. Moreover, if we may judge the future by the past, the services of birds must become increasingly valuable as time goes on. Agriculture, always important in the United States, is constantly assuming greater importance. The stream of immigration from the Old World and the steady increase of our own millions mean an ever-augmenting consumption of food at home, while the demand from abroad

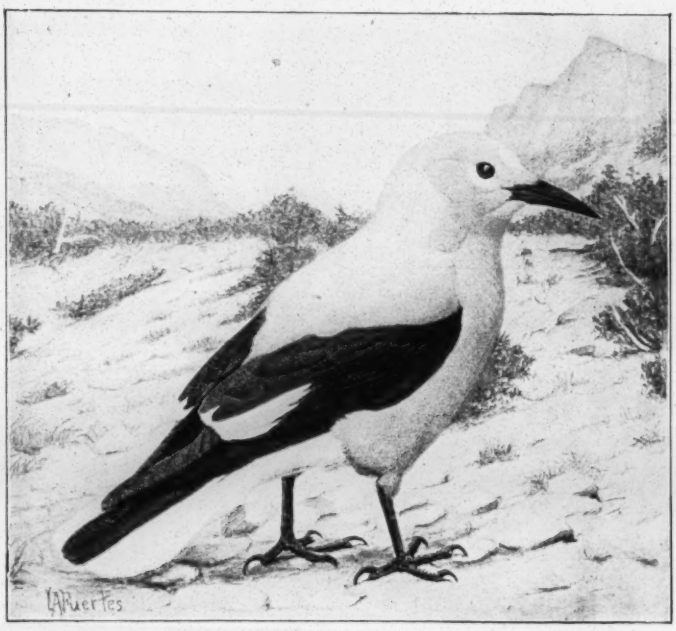
for American foodstuffs never ceases for a moment. To supply this triple demand, better methods of tillage must be devised and more and more acreage must be devoted to agriculture. In part this need of increased acreage is to be met by irrigation projects, which when they materialize will make available for farms and homes millions of acres of sterile desert.

WITHOUT BIRDS SUCCESSFUL AGRICULTURE WOULD BE IMPOSSIBLE.

But increased acreage and larger crops mean a vast increase of insect life as the result of a more constant and abundant supply of food. Even now, despite the incessant warfare waged against them, insects are not diminishing in numbers. On the contrary, in many localities they are increasing. Especially are new pests finding their way into the country, and as these usually are unaccompanied by the enemies which keep them in check at home, they frequently run riot in the new- these usually are unaccompanied by the enemies which keep them in check at home, they frequently run riot in the new-found Paradise. Well-known instances are the cotton boll weevil and the gypsy and brown-tailed moths. It is estimated by entomologists that the annual loss of agricultural products from insect ravages in the United States is not less than $500,000,000. To birds, then, we must look for allies in the continuous warfare against insect pests, and if they are to play even the same relative part in the future as they have in the past, they should not only be protected, but determined efforts should be made to increase their numbers and make their work more effective.

What would happen were birds exterminated no one can foretell with absolute certainty, but it is more than likely—nay, it is almost certain—that within a limited time not only would successful agriculture become impossible, but the destruction of the greater part of vegetation would follow. It is believed that a permanent reduction in the numbers of our birds, even if no species are actually exterminated, will inevitably be followed by disastrous consequences.

The strict enforcement of bird-protection laws is the more important, since of recent years thousands of immigrants from the south of Europe have reached our shores who appear to be wholly ignorant of the value of birds to man except for food, and who exhibit a total disregard for the spirit of bird laws, and little for the letter, except in so far as infraction brings sure and swift punishment. In the eyes of many of these recent comers, no bird is too small to serve as food; no bird too valuable to serve as a mark for the gun. Birds' songs have



From the Biological Survey

CLARK CROW

A bird of the high pine forests in the Rocky mountains

From the Biological Survey

SAGE HEN

Our largest grouse; resident on the sage brush plains of the western United States

no purpose in their ears but to indicate the whereabouts of their victims. Hunting small birds with them is a passion. Unless speedy cognizance is taken of the tendencies of this rapidly increasing class of immigrants, some of our most valuable song and insect-eating birds will be in danger of extermination.

It should arouse a feeling of pride in Americans that our Republic has taken a foremost place among the nations that care for and protect birds. Much has already been accomplished in this country in the cause of bird protection, but much still remains to be done. So long as dead birds for hat gear are valued at a higher rate than living birds, and so long as game birds count for more in the way of sport and food than as active working friends of the farmer, so long will there be missionary work to do for such organizations as the Biological Survey and Audubon Societies.

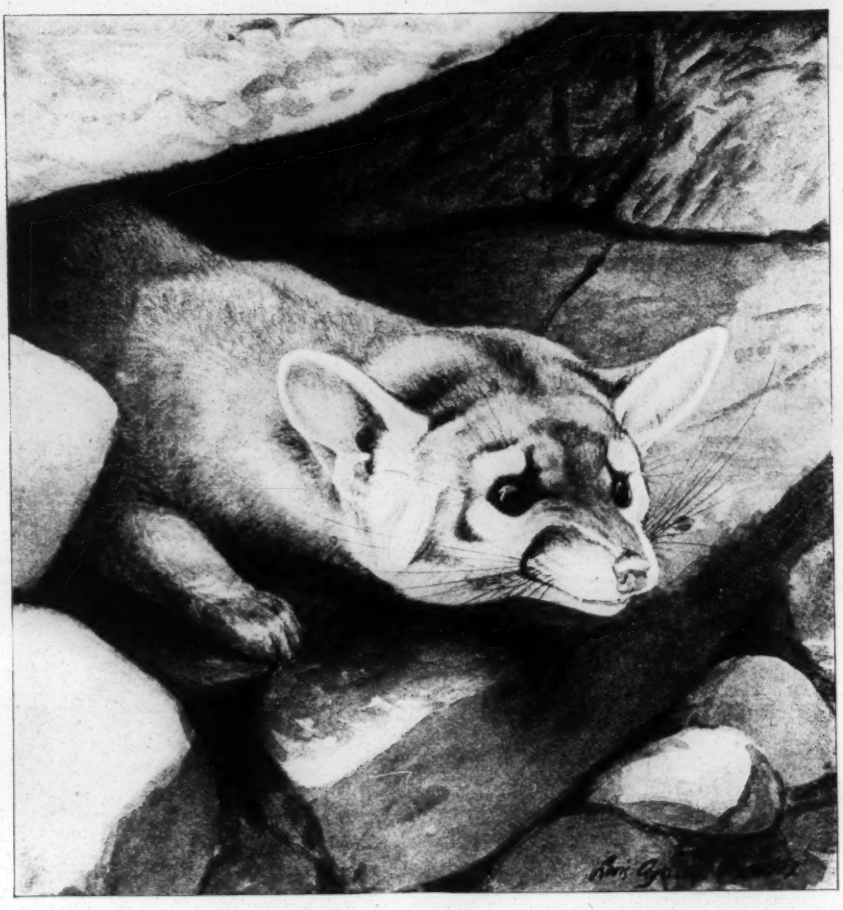
MANY OF THE SMALL MAMMALS BECOME PESTS

The relations of mammals to agriculture are very different from those of birds. Most birds, as has been shown, are beneficial, even those with injurious habits, as a rule, compensating in whole or in part for the damage they do. Such is by no means the case with mammals. As a result of the investigations of the Biological Survey, some of our common mammals indeed have been found to perform valuable service to man. To this class belong the bats, moles, and shrews, which are insectivorous; the badger, which is an indefatigable mouser when it cannot find larger game in the shape of prairie dogs and similar rodents; and the skunks and weasels, which destroy vast numbers of insects as well as mice. The fox, wild-cat, ring-tailed civet, and opossum also are believed to be useful in the main, as they eat many insects and small rodents and by no means destroy as much game as is popularly supposed. Reynard's raids on the poultry yard are not common, and they are so easily guarded against that they should count but little in the scale against him. Even coyotes when they follow their natural bent perform an important service—they keep down the number of rabbits, which constitute their natural prey. Unfortunately, however, the coyote early contracted a taste for mutton, and in some regions successful sheep-raising is practically impossible because of its destructive raids. Experiments are being made by the Biological Survey and Forest Service to discover a cheap method of fencing by means of which depredations on sheep may be prevented. Effective fencing of sheep against coyotes will compel these animals once more to rely for food chiefly on rabbits, prairie dogs, and other destructive rodents.

When all has been said, however, the list of our wild mammals that are of essential service to man is comparatively small, even if we include in it a number which are harmful and beneficial by turns, like minks, coyotes, foxes, and others, compared to the army that are always and everywhere injurious.

WOLVES CAUSE MILLIONS OF DOLLARS OF LOSS YEARLY

It was predicted that the extermination of the buffalo would be followed by that of the big wolf, so intimately associated were the two in the days when the wolf used to prey on the young, the aged, and the crippled buffalo; and for a time after our largest native mammal succumbed to the robe-hunter it seemed as if the prediction was likely to be fulfilled, so scarce did wolves become. But the old buffalo ranges soon filled with cattle, and the wolf took on a new lease of life, and in some localities now threatens to become as numerous as in former times. The value of the cattle destroyed annually by wolves amounts to millions of dollars, and this despite the payment of large sums as bounty for wolf scalps. After investigation the Biological Survey has recommended measures which it is believed will prevent the greater part of the damage. The most important of these are the systematic use of poison and the destruction of the wolf pups in the breeding



From the Biological Survey

THE RING-TAILED CIVET CAT OF THE SOUTHWESTERN UNITED STATES

A first-class mouser

dens. Wolves breed early in the year, and when snow is on the ground may be tracked to their dens with absolute certainty. Even when the ground is bare, a skillful tracker, familiar with the country and with the habits of the animal, can usually locate the dens. By destroying the increase and by the judicious use of poison to insure the death of the old ones, several millions of dollars may be saved to the stockmen annually even now, while the measures recommended, if energetically and persistently followed up, are likely to result in the practical extermination of these savage pests.

RATS AND MICE ARE OUR MOST DREADED ENEMIES

But the damage by wolves, panthers, coyotes, and all the carnivores put together does not begin to equal the destruction wrought by the army of small rodents, individually insignificant but collectively a mighty pest. Rats alone do an almost incalculable amount of harm in the United States, and everywhere they are deservedly dreaded, all the more since by long contact and constant conflict with man they have become extremely sagacious and wary, and thus far have been able to defy his utmost efforts

From the Biological Survey

TEXAS WILD CAT
An active foe of noxious rodents

to exterminate them, or even to seriously reduce their numbers, and as if the measure of their iniquity were not filled by the wholesale destruction of merchandise, household goods and foodstuffs, they are now known to serve as carriers and disseminators of that dread disease, the plague; so that measures to exterminate them, wherever that is possible, are doubly important.

When is added to the total damage done by rats the results of depredations by meadow and house mice, by prairie dogs, rabbits, gophers, ground squirrels, and other small gnawing animals, the resulting total, could it be ascertained, would stagger belief. Unfortunately accurate statistics of such damages are for the most part wanting, but a single item is suggestive. One of the small ground

Photo by Viola McColm

NOT DEAD, BUT PLAYING POSSUM

squirrels of Washington injures the wheat crop in a single county of that State to the extent of half a million dollars annually. While the loss to this country by rodents by no means equals that caused by insects, the total reaches far into the millions and is a serious drain on the national resources.

To devise methods of combating these pests, of reducing their numbers, and, if possible, of accomplishing their extermination is one of the important problems dealt with by the Biological Survey. By the use of traps, of poisoned foods, and of gases to kill the animals in their burrows, much has been accomplished. Failure to secure the utmost results aimed at by these methods is due chiefly to the difficulty of securing the coöperation of all the farmers in an infested region. It is evident that if a number of landholders withhold their aid, their farms become nurseries from which to repopulate adjoining districts. Moreover, in most regions there are sterile and unproductive areas which receive no attention, and these again are harbors of refuge for the pests which later emerge to restock farming lands. Hence the contest appears to be a never-ending one, and is a constant source of loss and annoyance to the farmer.

The difficulties of warfare against rodents are in inverse proportion to the settlement of the country. Where farms are large and there is much waste land, the difficulties are very great; but when farms are comparatively small and there is little unoccupied land, coöperation between landholders is easier to secure and results are more encouraging. In parts of Kansas, for instance, where formerly farming population was scarce and prairie dogs numerous and destructive, the animals have been practically exterminated as the result of the continued effort of numerous ranchers working together for a common end and aided by the state.

In attempting to devise more effective means of abating rodent pests the attention of the Survey has been turned to a

Photo by Viola McColm

COMMON SKUNK WADING THROUGH SLUSH—KANSAS

Photo by Bailey, Biological Survey

GRAY FOX—NEW MEXICO

study of the use of epidemic diseases—nature's own method of destroying surplus population. It has long been known that at irregular intervals, when mammals, especially rodents, that live in crowded communities increase till they are very numerous, they are suddenly smitten with an epidemic which almost wipes out the species over a considerable area. In the case of such epidemics a certain number of individuals either are immune to the disease or recover from it; for while nature is prodigal with the lives of individuals and wastes them with apparent recklessness, she cherishes the species and is chary of exposing one to the risk of elimination. After a few years the animal that has paid the price of too great prosperity again multiplies beyond limits, to be again reduced.

Efforts are now being made to obtain cultures of the diseases which prevail among the more destructive of our rodents, so that they may be employed in other regions where the animals are pests. Since the cultures may be renewed from time to time, they can be kept indefinitely and be ready for use as required. If they prove as effective as when employed by nature, the problem of a cheap and reliable method of dealing with destructive rodents will have been solved.

FOX FARMING

Time was when it might almost have been said that America furnished furs for the world, and even now no inconsiderable part of the fur harvest comes from America. Year by year, however, the harvest is diminishing, while the price of furs is steadily advancing, till the finer and rarer kinds are within the reach of only the very wealthy. Foxes of the more valuable kinds, for instance, once so numerous in this country, are now comparatively scarce. Their fur is so valuable and so much sought for that, instead of trying to discover means to compass their destruction, the Survey is now studying the best methods of fox farming, with a view to making the breeding of the

TYPICAL BREEDING GROUNDS OF COYOTES IN WESTERN WYOMING

Photos by Bailey, Biological Survey

COYOTE PUPS AT MOUTH OF BREEDING DEN IN WYOMING

A family of coyote pups was found in the hole near cross on extreme right

Photo by Bailey, Biological Survey

A MUTE WITNESS TO THE DESTRUCTIVENESS OF MICHIGAN WOLVES—BODY OF DEER LYING ON THE SNOW

animal in confinement not only possible but remunerative. When silver fox skins are worth from $300 to $600 a skin it does not need a Colonel Sellers to see golden possibilities in the business.

The raising of mink and beaver, and perhaps otter, for their fur is also thought to be entirely feasible. The beaver is being protected in Canada and in some of our own states. It should be protected in all, for apparently protection is all that is required to enable the animal to reëstablish itself in many of its old haunts. After being safeguarded for a term of years, judicious trapping might then be allowed, and thus this remarkable and valuable fur-bearer be preserved indefinitely, to be a source of both interest and profit to future generations. Even the despised skunk, which is easily cared for and is wonderfully prolific, can, it is believed, be raised in confinement with profit.

The idea of raising furs for the market is by no means new. Many attempts have been made to breed foxes for profit, especially in certain islands of Alaska, where the conditions would seem to be ideal. Some of the ventures appear to have proved remunerative, but many failures have resulted, chiefly as the result of inexperience and lack of knowledge, especially of the proper feeding and care of the animals. It is thought that the difficulties are by no means insuperable and that they can be overcome by study and carefully conducted experiments.

Thus the ends sought by the Biological Survey in its investigations of mammals differ considerably from those aimed at in its study of birds. The more carefully birds' habits are studied and their food investigated, the more apparent is it that man cannot do without them. Such is by no means true of many of our indigenous mammals. Some are valuable because they destroy noxious insects and noxious mammals; others because they furnish skins for use and comfort; but many are wholly noxious, or so nearly so that they can be safely classed as such, and their destruction compassed in every possible way, though always with the entailment of as little suffering as possible.

APPLE TREE KILLED BY RABBITS

Photos from the Biological Survey

APPLE TREE KILLED BY FIELD MICE

Photo from the Biological Survey

PRAIRIE DOGS AT MOUTH OF BURROW

LIFE AND CROP ZONES

It has long been recognized that plants and animals are not distributed fortuitously over the earth, but in their distribution are governed by well-defined laws. Certain species and groups of species are restricted to certain regions because of peculiarities of climate, temperature, and soil, summed up under the word environment, essential to their well being.

Cultivated plants are wild plants tamed—wild plants modified to some extent by care and cultivation—but in their nature and all essentials akin to their uncultivated ancestors. To a great extent, then, the laws of distribution that apply to wild plants and animals apply equally well to cultivated varieties. The ready application of these facts will appear from an example. If on a certain mountain side a particular crop is found to thrive, and the observer happens to know the particular plants, birds, and mammals natural to the locality, when he visits a different region where the same plants and animals find a congenial home he may be sure that the crop in question will thrive there also.

Such being the case, it was early perceived that a study of the distribution of wild plants and animals and the mapping of the natural areas of distribution could be made to serve a practical use, whereby the farmer would be saved enormous expense in experiments to ascertain the particular crops adapted to new localities. Accordingly, in the summer of 1889 Merriam selected the San Francisco mountain region of Arizona for an experimental survey, and it is not too much to say that the results of the work there revolutionized prevailing conceptions of the principles of geographic distribution.

In ascending the mountain a succession of climatic belts were traversed, similar to the ones to be noted in traveling from our southern boundaries to the Arctic, each zone or belt being characterized by a distinct set of animals and plants.

Photo by Viola McColm

VERY YOUNG COTTONTAIL RABBITS IN NEST

Among other results it was demonstrated that the laws governing the distribution of mammals, birds, reptiles, insects, and plants are essentially the same. Hence a map showing the boundaries of an area inhabited by an association of species of one group serves equally well for the other groups. Comparison of the facts of distribution as noted on this mountain with corresponding facts over the country at large disclosed three important truths: (*a*) That the several life zones of the mountain could be correlated with corresponding zones long recognized in the eastern United States; (*b*) that these same zones are really of transcontinental extent, though never before recognized in the West; and (*c*) that the faunas and floras of North America as a whole, and, for that matter, of the Northern Hemisphere north of the tropical region, are properly divisible into but two primary life regions—a northern, or Boreal, and a southern, or Austral (then termed Sonoran), both stretching across the continent from ocean to ocean.

Subsequently a careful study of the geographic distribution of plants and animals was undertaken, to include the whole of the United States and, where necessary, the region contiguous.*

The practical use of zone maps is easily understood. If, for instance, it is ascertained that a certain crop thrives in one part of a particular zone, it is to be expected that elsewhere within the zone, where similar local conditions prevail, the same or a closely allied crop will do well. As each zone includes thousands of square miles, the value of such information is obvious.

The final step toward making such

* The first announcement of the laws of temperature control of the geographical distribution of terrestrial animals and plants was made in this Magazine, vol. VI, 1894.

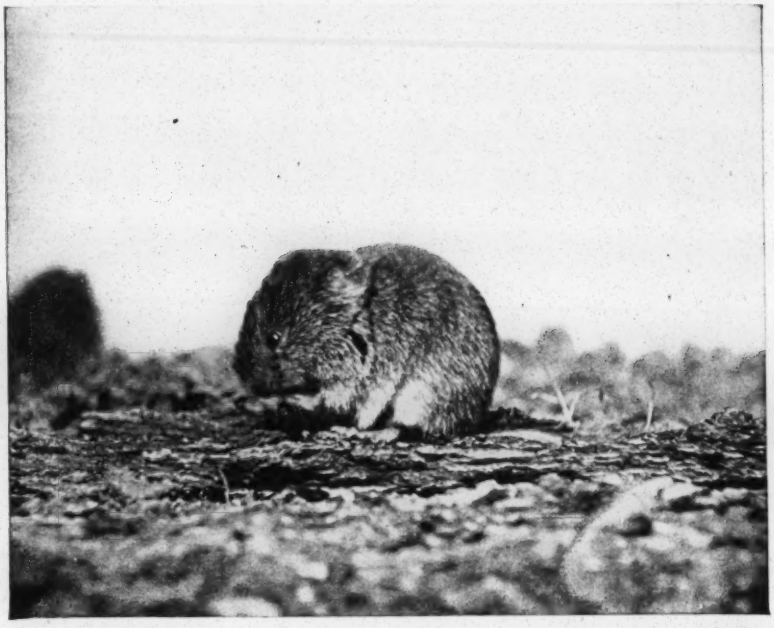


Photo by E. R. Warren

FIELD MOUSE

When numerous field mice do enormous damage to crops (see page 92)

zone maps of the utmost practical use—and a very important one—is to accompany the maps with a list of the fruits, grains, and vegetables best suited to each zone. Thus the necessary experimentation on the part of the farmer is reduced to a minimum. The farmer who wishes to find land where a certain crop may be planted with success, or the emigrant in search of conditions similar to those he is familiar with at home, has only to refer to the zone maps and to the lists connected therewith.

A small scale zone map of the United States has been completed, with lists of the farm products most likely to thrive in the several belts. While for general purposes this map is very useful, it is by no means detailed enough to give all the information the farmer or emigrant in search of a new location desires. It is the present purpose to survey each important agricultural state with sufficient detail to enable life and crop zone maps to be published, with lists of the crops specially adapted to the several parts of the respective states.

Such crop and zone maps are useful in still another field. At the present time the whole world is being searched by specialists for fruits and plants, suited to the conditions that prevail in our own country. The usefulness of such maps as a guide to the most favorable localities in which to test the value of these foreign importations can hardly be overestimated.

Noxious insects also in their dispersal over the country follow the same faunal belts, as do also many of the diseases of domestic stock and even of man. Yellow fever, the germs of which are now known to be distributed by a mosquito, has been shown to be limited to a transcontinental belt the boundaries of which were laid down by the Survey nearly twenty years ago.

Curiously enough the regions formerly occupied by particular tribes of Indians correspond in a general way with these same life zones, as was pointed out by

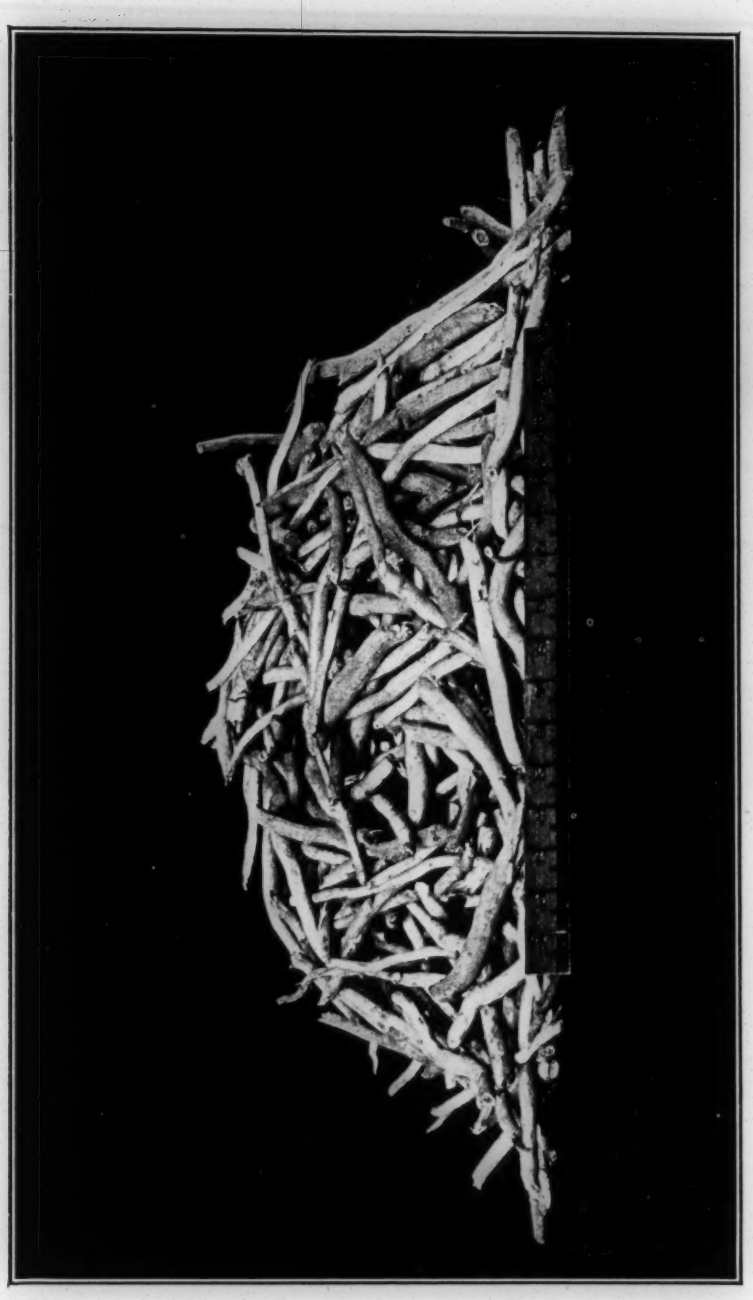


Photo from the Biological Survey

SECTIONS OF MORNING GLORY ROOTS STORED BY FIELD MOUSE FOR WINTER FOOD SUPPLY

From burrow on Potomac Flats

Photo by Osgood, Biological Survey

SHELTER-HOUSE ON FOX FARM IN MAINE

Merriam. The Indian was largely dependent for his livelihood upon the natural fruits of the earth and upon game, in the same way, though not to the same extent, as were wild animals. Thus the distribution of acorns, camas, pine seeds, wild oats, and the thousand other wild crops, as well as that of the birds and animals which furnished them food and raiment, to a great extent determined the favorite haunts of the aborigines of this continent.

GAME PROTECTION AND KINDRED SUBJECTS

What a glorious heritage of game, both bird and beast, was bequeathed by the Indians to our forebears, and with what prodigality has it been wasted by them and by ourselves! Neither motives of humanity nor far-sighted prescience deterred the Indian from wanton slaughter of game. He killed animals and birds, however, not for sport, but for food, shelter, and raiment, and the very abundance of game and his imperfect weapons made game laws restrictive measures in his time as unnecessary as they were undreamed of.

Very different are present-day conditions. Of the almost infinite number of game birds and animals that once filled our mountains and valleys only a small remnant is left. The buffalo, that ranged from the Atlantic to beyond the Rocky Mountains and blackened the plains with its countless numbers, is practically extinct in its wild state; the antelope, bands of which everywhere dotted the plains, is rapidly approaching the same fate; moose and caribou, though still occurring over much of their former range, are being greatly reduced in numbers; while elk, deer, and mountain sheep are quite unknown over much of the territory they formerly inhabited. Our game birds are facing the same fate. The present generation knows not the wild pigeon, flocks of which used to darken the sun as they swept across country. The various

Photo by Bailey, Biological Survey

ASPEN BEING FELLED BY BEAVER—NOTE SIZE OF CHIPS

Photo by Bailey, Biological Survey

BEAVER DAM FROM BELOW—NOTE STORAGE POND ABOVE DAM

The beaver is a natural ally of the reclamation engineer

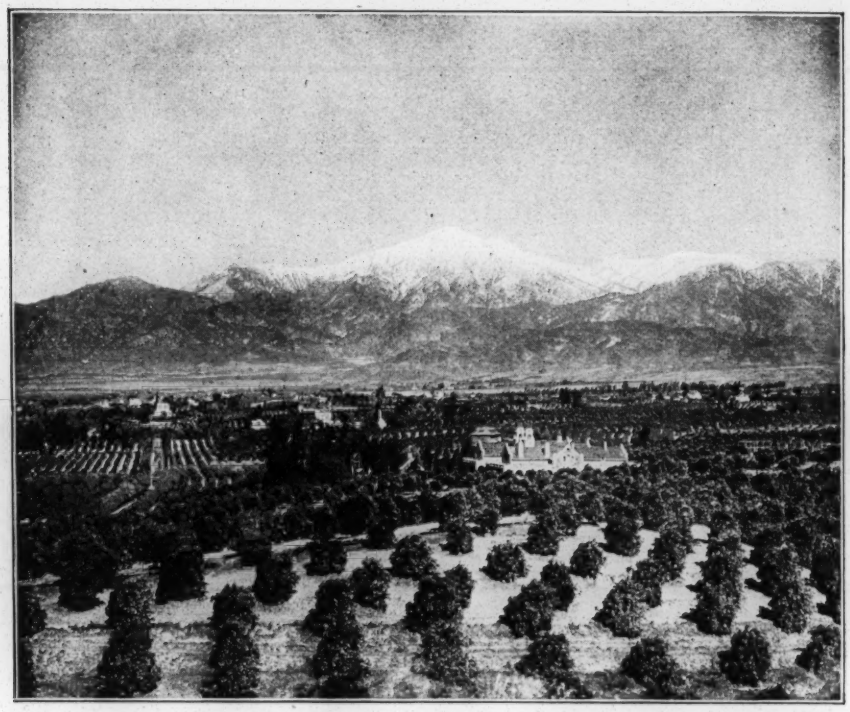
Photo from Mrs Charles Shaffer

HUDSON BAY SABLE

One of the most valuable American fur bearers

species of grouse and quail have been decimated in many regions till only a beggarly remnant remains, and even ducks and geese, that with the changing seasons once thronged our tidal waters and waterways, have been so mercilessly slaughtered that the future prospects of more than one species looks dark. All of our waders have been reduced in numbers and many are almost unknown where formerly they used to cover the sand and mud flats. Such facts sufficiently empasize the need of game protection, and the study of ways and means of preserving such of our game birds and animals as still survive is regarded as one of the pressing duties of the Biological Survey.

We Americans did not at first welcome the idea of close seasons, license systems, game refuges, game wardens, and the other measures necessary for the protection of wild life. To our forefathers of not long ago the privilege of killing game when needed was an absolute necessity, and we have been so long accustomed to the idea that game is public property, to be appropriated by the first comer, that we do not take kindly to restrictions of any sort. Nevertheless both the theory and practice of game and bird protection are now firmly rooted in this country,



By courtesy of the *Pacific Monthly*

ORANGE GROVES OF SOUTHERN CALIFORNIA

In climbing the mountains in the background one traverses in succession all the life zones from the orange belt (Lower Sonoran zone) to the frigid treeless summit (Alpine zone)

simply because of the self-evident fact that without at least a measure of protection there will soon be no game left. No duty can be plainer than to so care for our game animals that the species may be perpetuated for the pleasure and use of future generations. We cannot indeed pass on in full measure the heirloom we received, but many of our finest game birds and animals still survive, to insure a future supply, provided we refrain from wanton slaughter and protect both wisely and well. The theory that wild game is not and cannot be made the property of the individual, but that it belongs to the state, which has the power to regulate its use and preservation, is now recognized almost everywhere, and the recognition of this principle has greatly aided the cause of game protection.

As the supply of native game birds diminishes, there appears to be a growing tendency among sportsmen to import birds from foreign countries for restocking covers, and the Survey is constantly in receipt of requests for information on this subject. European partridges, capercailzie, black game, willow and hazel grouse, and several kinds of pheasants have already been experimented with. It is yet too soon to decide as to the ultimate outcome of most of these efforts, but in the West, especially in Oregon and Washington, the introduction of pheasants has been successful, and in certain localities two species of these superb game birds are very numerous. In parts of the Atlantic States also they have been successfully acclimatized.

Should it prove, as now appears probable, that along with pheasants and other

foreign game birds diseases have been introduced which threaten the safety of our own native game birds, sportsmen may conclude that by the importation of foreign species they have lost more than they have gained.

As most birds, including ducks and geese, are migratory and do not breed in the states through which they pass in spring and fall, many now advocate measures placing all migratory birds under federal control. The present diversity of state laws and the wide differences in the dates of their open and close seasons are the chief arguments for delegating the care of migrants to central authority. That the effect of such a measure would be to improve existing conditions and extend the lease of life to many species of ducks and shore birds now fast approaching extinction can hardly be doubted.

BIG-GAME REFUGES

The use of government reservations for the preservation of wild animals in danger of extinction is a practical form of protection which cannot be too highly commended. The experiment on a large scale was first tried in Yellowstone Park, and the results there have been most encouraging. Despite some poaching, elk, antelope, and mountain sheep have steadily increased in numbers, while buffalo also have thriven wonderfully.

The high price paid for elks' teeth is a constant temptation to lawless hunters to kill these superb animals. It is to be hoped that the organization chiefly responsible for this demand will by official action repudiate elks' teeth as a necessary emblem of the order, and thus lend material assistance in the effort to preserve this, the noblest of our game animals.

It is a pleasure to note that the cooperation of private parties with the government authorities in efforts to perpetuate our game animals are not wanting. An instance in point is Miller and Lux's generous offer to the government of their herd of elk on the Button Willow Ranch, California. In 1905, under the direction of the Biological Survey, some 20 of these animals were successfully transferred to the Sequoia National Park, in Tulare County, where they promise to form the nucleus of a large herd of this fine species.

The New York Zoölogical Society is also actively interested in the preservation of our big game. Through its generous coöperation, the Wichita Game Preserve in Oklahoma has become the permanent home of a herd of buffalo. The animals are confined to a suitable area by means of a strong fence, and, as the preserve is in the midst of their former range, the success of the experiment would seem to be assured. Under what appear to be ideal conditions, the herd is likely to increase notably, so that in time it will be possible, if desired, to stock other reserves from the surplus.

13 BIRD RESERVATIONS

The theory of the bird reservation is nearly akin to that of the game refuge. Formerly our coast teemed with bird life, which consisted not only of migrants from the far north, but of summer residents, which found the rocky and sandy islets of our shores a very birds' paradise. The rage for hat birds changed all this and converted most of the former bird resorts into solitudes, so far as bird life is concerned. By setting aside here and there an island of no particular use for other purposes, the government has established nurseries and winter resorts where sea birds undisturbed may rear their young and find shelter. The plan has the energetic coöperation of the National Audubon Society, which has established island reserves of its own, and whose good work in this and other fields cannot be too highly extolled. The results attained are exceedingly satisfactory, and thousands of gulls, terns, pelicans, and other sea birds are reared each year in these bird resorts. Pelican Island is likely to become one of the sights of Florida, and already many tourists have sought permission to visit

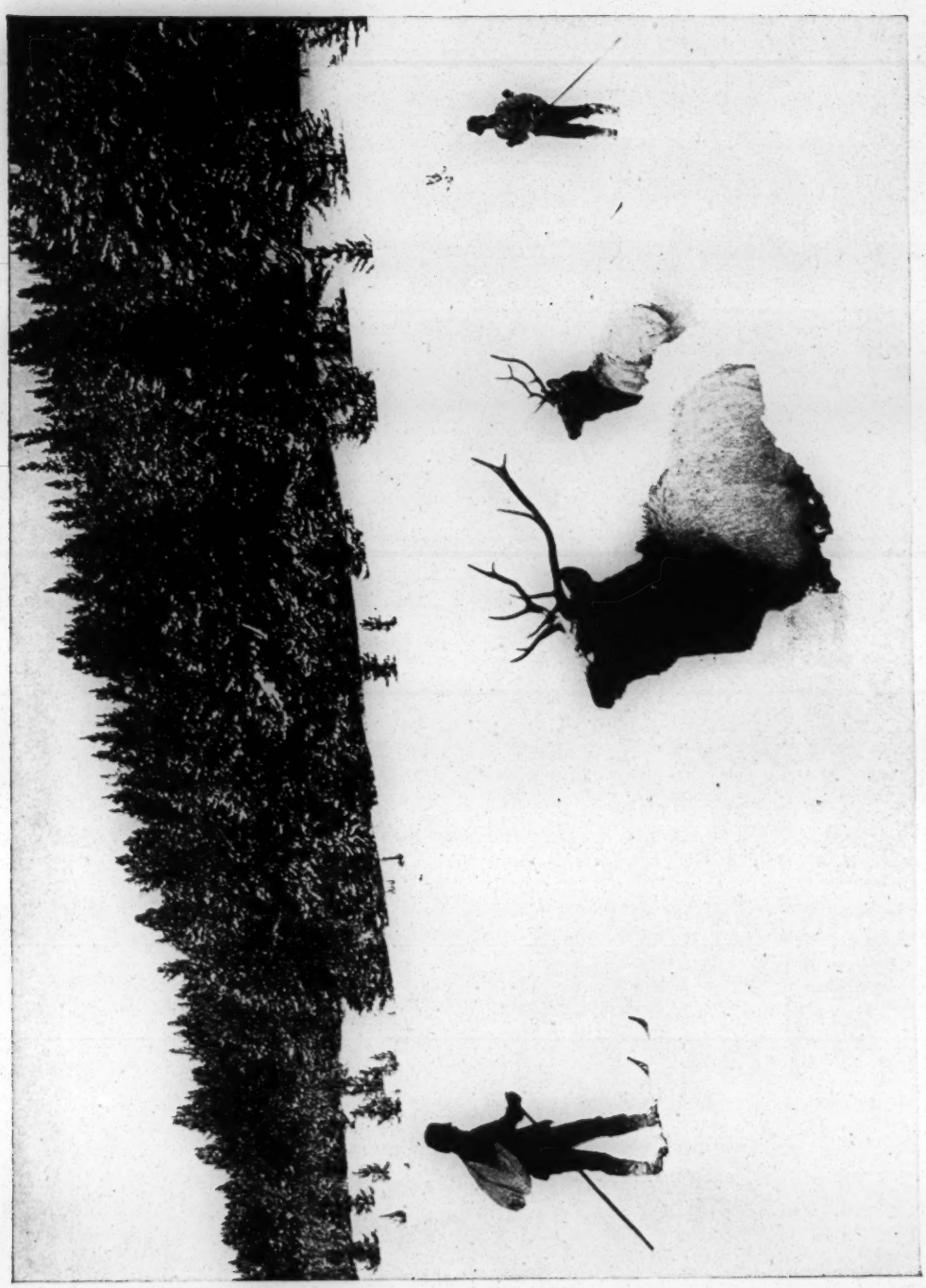


Photo by F. J. Haynes

ELK IN DEEP SNOW, YELLOWSTONE PARK

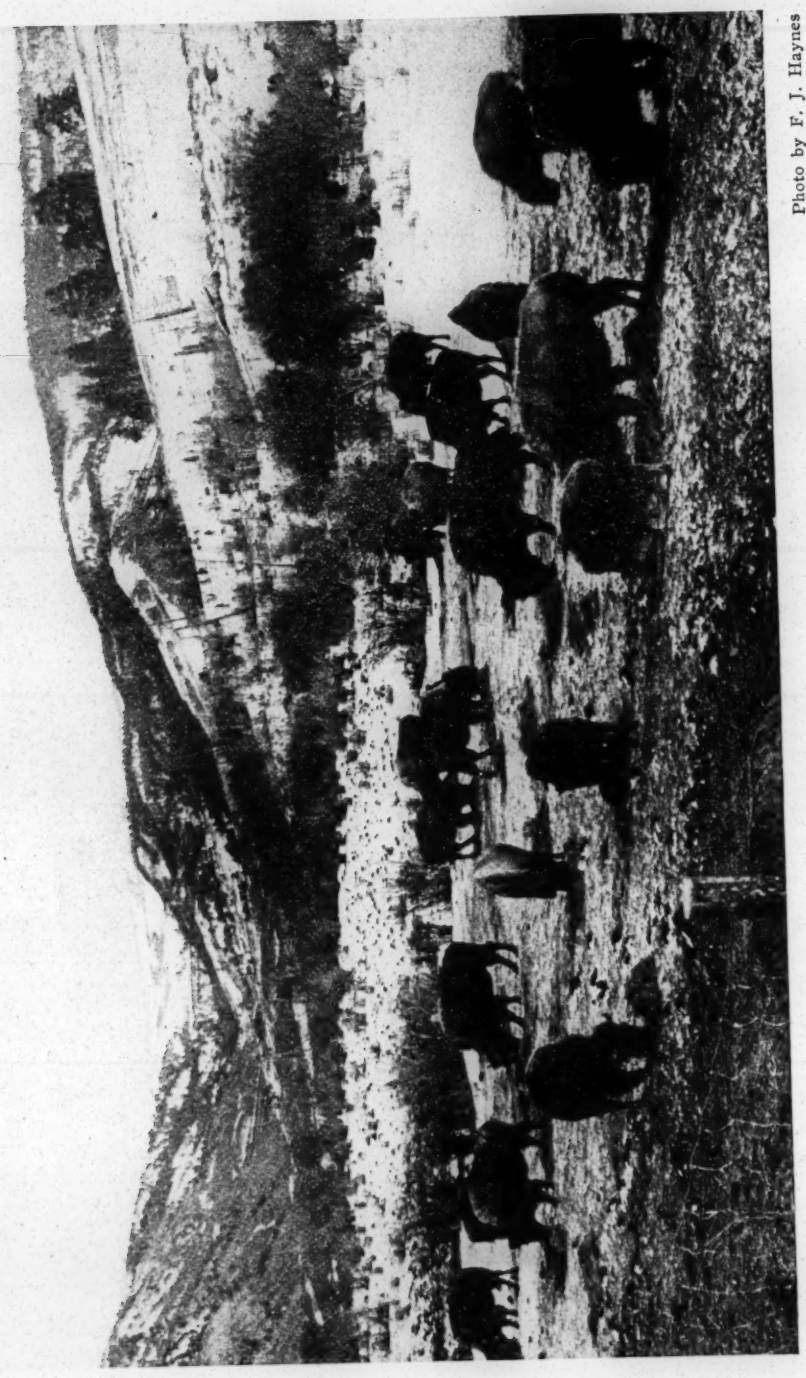


Photo by F. J. Haynes

BUFFALO IN YELLOWSTONE PARK

TWIN BLACK BEAR CUBS—YELLOWSTONE PARK

Photo by F. J. Haynes

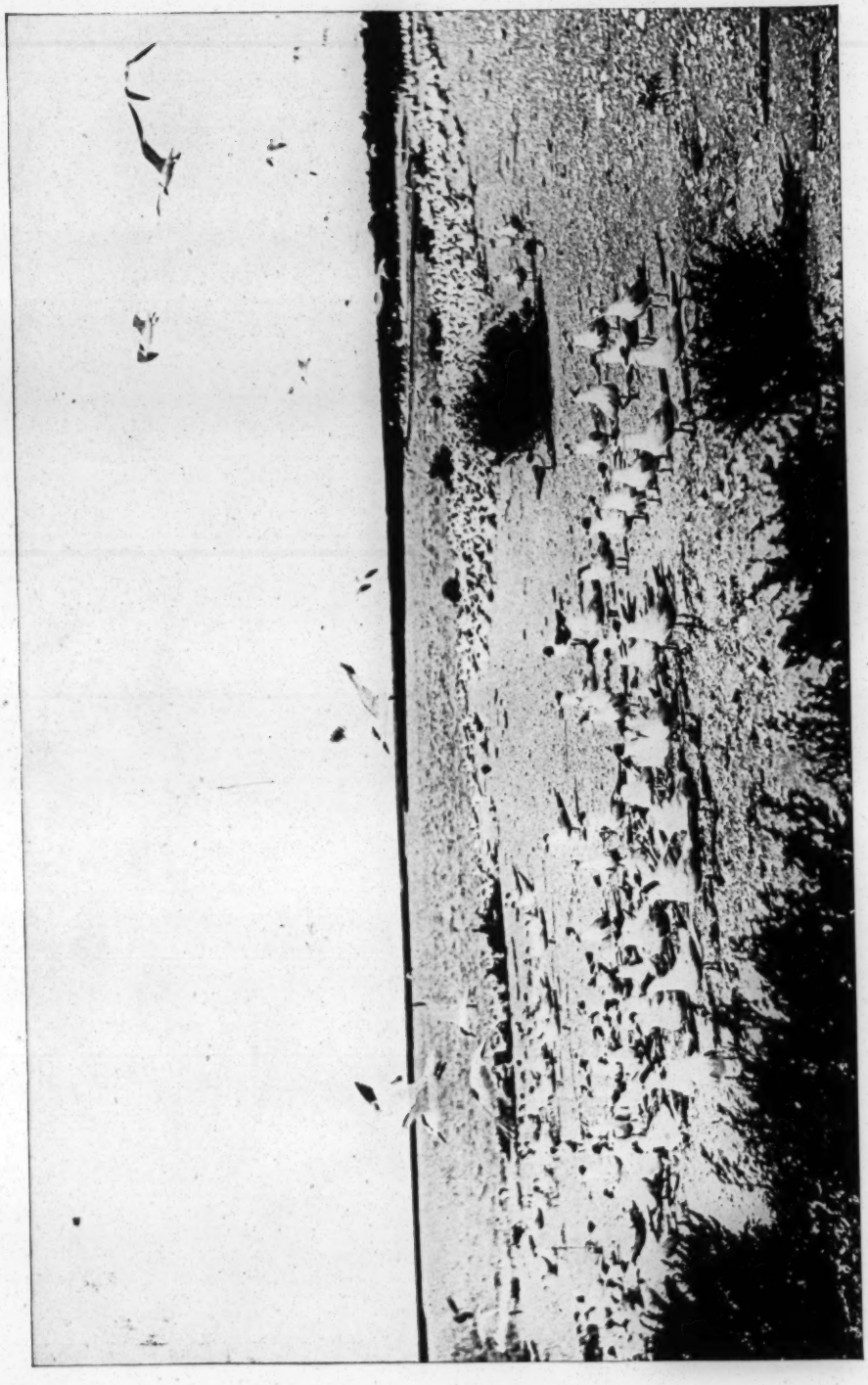


Photo by Frank Miller, July, 1907

ROYAL TERNS BREEDING ON BATTLEDORE ISLAND, COAST OF LOUISIANA—AUDUBON RESERVATION

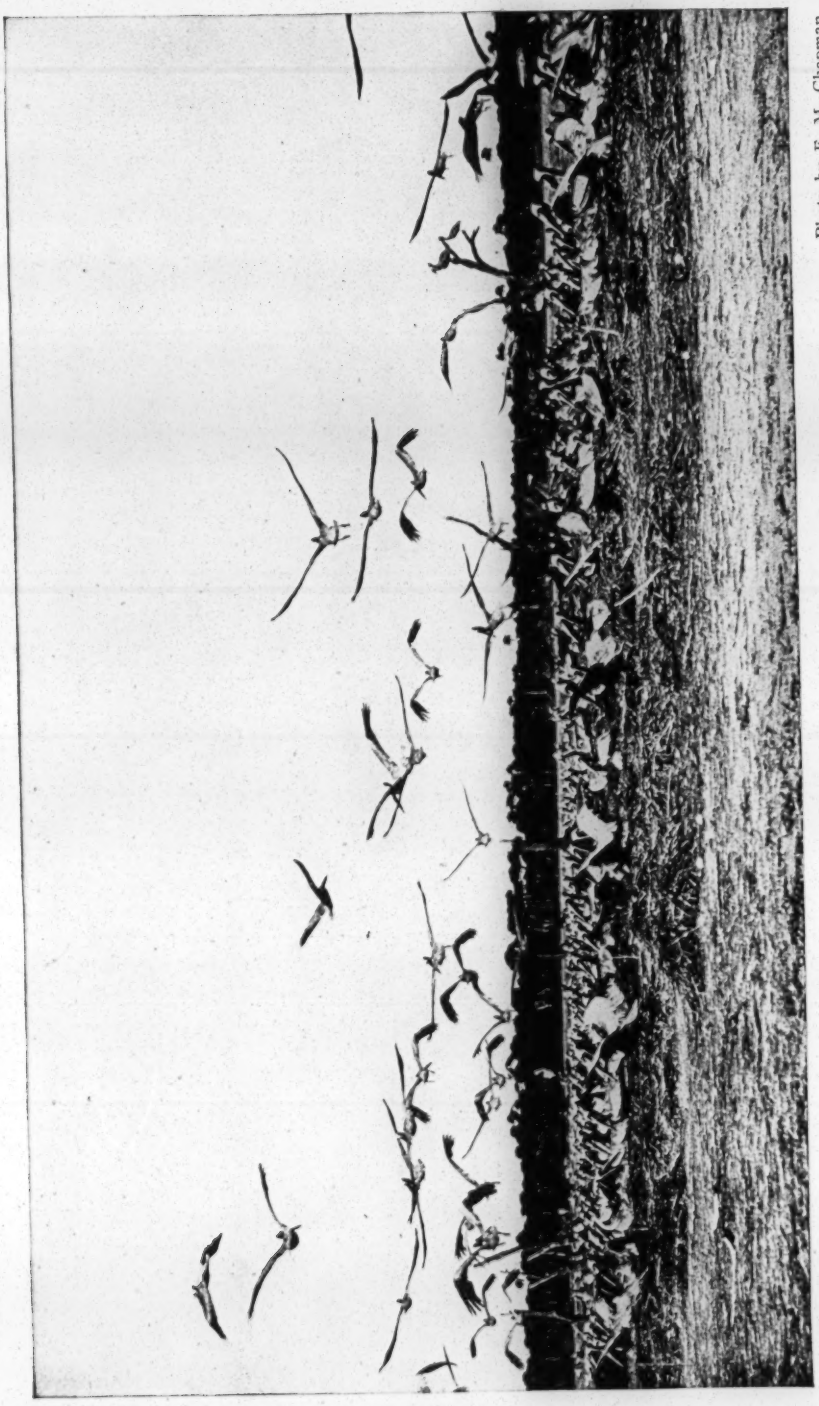


Photo by F. M. Chapman

A BROWN PELICAN COLONY, PELICAN ISLAND RESERVATION, FLORIDA

Photo by Finley and Bohlman

CALIFORNIA MURRES ON THREE ARCH ROCKS, OFF THE OREGON COAST

One of the reservations recently made by order of the President to protect the breeding grounds of sea fowls

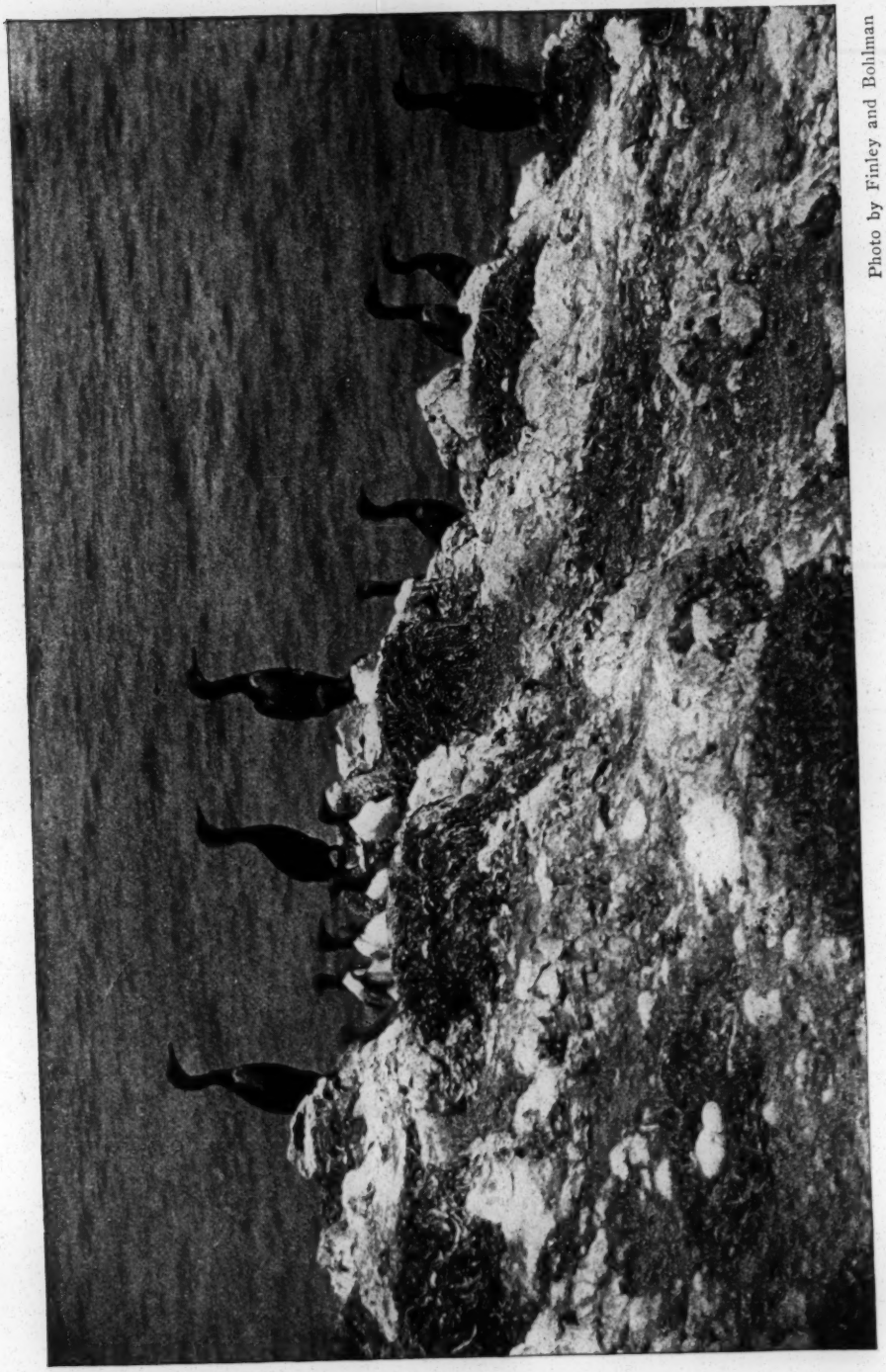


Photo by Finley and Bohlman

CORMORANTS NESTING ON THREE ARCH ROCKS BIRD RESERVATION, COAST OF OREGON

Photo by D. Lange

YOUNG CORMORANTS, DEVIL'S LAKE, NORTH DAKOTA

it to view the ungainly but interesting birds attending to their domestic duties.

As a final result of the establishment of bird refuges, there is every reason to believe not only that these island bird colonies will be maintained intact, but that in time the birds will so multiply as to restock other islands not under the control of specially appointed wardens. Thus far 13 reservations have been set apart by the Government: Breton Island, Louisiana; Pelican Island, Passage Key, and Indian Key, Florida; Stump Lake, North Dakota; Huron Islands, off the south shore of Lake Superior, Michigan; Siskiwit Islands, south of Isle Royale, Lake Superior; and a series of islands off the coast of Oregon and Washington.

PROTECTION OF GAME IN ALASKA

The big game of the world is fast being killed off. Nowadays no region is too wild or remote to attract the sportsman and the trophy hunter. Those who read the accounts of the African explorers of scarcely more than a generation ago never dreamed that in a short time the vast herds of wild game over the greater part of that continent would be a thing of the past. Alaska has now become the Mecca toward which the eyes of sportsmen are longingly turned, and were all restrictions on the export of trophies from that territory removed, a very short period would suffice to see the end of several notable game animals. The Kenai Peninsula contains the largest of the deer tribe in the world, the big Kenai moose, and horns of one of these animals, which sometimes spread 74 inches or more, command fabulous prices. Other Alaska game animals are greatly prized by sportsmen for trophies.

In a territory so remote from supplies as Alaska, game possesses more than ordinary value to its inhabitants, and the primary purpose of the Alaska game law was to preserve the game for the use of the people, both natives and white. To provide for emergencies, a special clause in the present law allows Indians, Eskimos, miners, and explorers, when in need of food or clothing, to kill game for their immediate use. Prior to the passage of the law, so many deer were killed for their hides as to threaten the extinction of these animals within accessible territory.

The law has been thought by many too drastic, and has caused much dissatisfaction.

A bill was introduced in the 59th Congress, and passed the House, which materially modifies the present law and is very liberal with regard to the shipment of trophies. It provides, among other things, for the issuing of licenses to hunt and to export a limited number of trophies and for the employment of game wardens and guides. Should this bill become a law, many of the present causes of complaint on the part of sportsmen and residents of Alaska will be removed.

THE LACEY ACT

The so-called Lacey act, approved May 25, 1900, marked a long and important step forward in the cause of bird and game protection. Prior to its passage the several states attempted in vain to prohibit the shipment of game beyond their boundaries. Game was forwarded to other states and sold in distant markets, without respect to season, under the plea that by such shipment it had become an article of interstate commerce and hence was beyond the jurisdiction of the state where offered for sale. All this was changed by the Lacey act, which struck at the root of the evil by prohibiting the shipment from any state of birds killed in violation of local laws, and placed imported game on the same footing as birds or animals produced within the state where the game was sold.

This act confers upon the Department of Agriculture important powers also in relation to the importation of foreign birds and animals, which prior to its passage was without check. It specifically prohibits the introduction of certain species, such as the English sparrow, starling, flying-fox, mongoose, and such others as may be declared injurious to agriculture; for with the growth of our

commerce the danger of the introduction of noxious birds, mammals, and insects is ever present. To prevent the introduction of birds and mammals likely to become pests is one of the special duties of the Biological Survey.

GUARDING AGAINST DANGEROUS IMPORTATIONS

The English sparrow serves as an ever-ready example of the disastrous consequences of the unwise introduction of a species into a new home. Under the present law and system of inspection, this pest could never have obtained a foothold in America, since so well known were the bird's habits in its native land that its disastrous career on this continent would have been foreseen and its entry prohibited.

Under the mistaken idea that the mongoose would prove beneficial by devoting itself to the destruction of small rodents, and ignorant of the fact that the animal is omnivorous and one of the most destructive creatures in existence, more than one attempt has been made to import it into the United States, where its successful introduction would prove nothing less than a national calamity.

Attempts to bring in numerous noxious birds and beasts have been frustrated only by the vigilance of the inspectors. It is, however, necessary to guard not only against intentional importation of noxious species from mistaken philanthropic motives, but unintentional ones; and when it is understood that under the 433 permits issued last year for the entry of foreign birds and animals were included 274,914 canaries, 47,383 miscellaneous birds, and 654 mammals, it will be seen that mistakes of identity by importers might easily be made, and that under the guise of innocent species noxious ones might find entrance. Every shipment of birds or beasts, therefore, is carefully scanned by expert agents, who seize upon noxious species and prevent their entry into the country by compelling their destruction or their return to the port of shipment. The Lacey act is not intended to restrict legitimate trade or work undue hardship on importers. In the great majority of cases it can be enforced so as to cause only slight delay and yet prevent the entry of species which may become pests.

As will appear from this short sketch, the work of the Biological Survey is eminently practical in its nature and intent. Beginning with investigations of the food habits of a few of our most important birds, the scope of its work has widened until it involves the study of all our birds and mammals in their manifold relations to man. The essential objects of this branch of the work are to show from a basis of ascertained fact the particular species that are beneficial and those that are injurious, and to indicate the best methods of preserving the one class and of destroying the other. Incidental to its main object, it endeavors to collect and to supply to those interested all available information relative to the distribution and abundance of our game and of our birds and mammals. Its list of publications is already a long one. Many of its reports are purely practical, intended for the information and guidance of the farmer; others are more strictly scientific and are designed to serve educational purposes.

Strange as it may seem, the United States, one of the youngest of the world's powers, is a pioneer in the kind of economic work outlined in the present paper. European countries, however, are now recognizing the immense importance to agriculture of such investigations and their absolute necessity as the basis for national and international laws.

As the world's population increases and as vast regions of land now wild and uncultivated are brought under the plow, so must investigations of the kind entrusted by Congress to the Biological Survey ever assume more and more importance.

A FEW THOUGHTS CONCERNING EUGENICS

By Alexander Graham Bell

The following paper is an address by Dr Bell to the American Breeders' Association at the recent convention of the Association in Washington, January, 1908. This Association was formed several years ago to encourage those persons of the United States working to improve our plants and animals. The President of the Association is Hon. James Wilson, Secretary of Agriculture, and the Secretary, Hon. Willett M. Hayes, Assistant Secretary of Agriculture. Every person who is interested in the scientific work of the Government and of individuals of the United States to create stronger and more productive varieties of animals or plants is eligible for membership. The Association is doing splendid work in collecting and distributing the results of the many workers along these lines. One branch of the Association includes efforts to improve the human race, and it was as a member of the Committee on this subject of eugenics that Dr Bell presented this address.

THE subject you have entrusted to your Committee on Eugenics is of transcendent importance to mankind. It is no less a question than the consideration of whether it is possible to apply the principles of selective breeding to man for the benefit of the human race. If it is true that "the proper study of man is man," no higher or nobler subject of research can be found.

I esteem it an honor to have been selected by you to serve on the committee having this matter in charge, and to be associated with the eminent men who compose the committee, under the leadership of Dr David Starr Jordan, President of Leland Stanford University. President Jordan, as chairman, has already presented a preliminary report for the committee, which has met with the ready acceptance of all the members.

As the Committee on Eugenics has not yet held a meeting for conference and discussion, it will of course be understood that anything I may say upon the subject today expresses merely my own individual views, for which the committee is in no way responsible.

The improvement of the human race depends largely upon two great factors, heredity and environment; and we deal chiefly with the question of heredity. It is a breeder's problem with which we are mainly concerned and not a question of education or environment.

We have learned to apply the laws of heredity so as to modify and improve our breeds of domestic animals. Can the knowledge and experience so gained be made available to man, so as to enable him to improve the species to which he himself belongs?

Can we formulate practical plans that might lead to the breeding of better men and better women? This is the great question we are called upon to consider.

The problem is one of great difficulty and perplexity, for its solution depends upon the possibility of controlling the production of offspring from human beings. By no process of compulsion can this be done. The controlling power, if it is possible to evoke it in the interests of the race, resides exclusively with the individuals most immediately concerned. This fact, I think, should be recognized as fundamental, so that our processes should be persuasive rather than mandatory.

The great hope lies in the fact that human beings possess intelligence, and a desire that their offspring may be fully up to the average of the race in every particular, if not superior. It is certainly the case that no man desires that his children shall be weak, sickly, defective, or in any way inferior in physical or mental endowments. A condition of sentiment therefore prevails that is eminently favorable to voluntary compliance

with plans that appeal to reason and sound judgment. The mere dissemination of information concerning those conditions that result in superior or inferior offspring would of itself tend to promote the production of the superior and to lessen the production of the inferior elements.

Knowledge is what is wanted, and the dissemination of that knowledge among the people. There is a wide field here for your Committee on Eugenics, or for some great national organization or society devoted to the increase and diffusion of knowledge concerning eugenics.

CONSANGUINEOUS MARRIAGES.

If it should be clearly shown that certain classes of marriages are hurtful to the offspring and others beneficial, the mere dissemination of that knowledge would of itself tend to promote desirable and prevent undesirable unions of the sexes. Would any reasonable person, for instance, think of marrying his first cousin, any more than he would dream of marrying his sister, if he really believed that any harm would result to the offspring; and if you could find one such person could you find two—for it takes two to make a marriage.

The fact that such marriages are contracted in spite of legislative prohibition in several of our states, and in spite of a considerable public feeling against such unions, simply shows that there is a difference of opinion upon the subject.

The only justification for legislative interference lies in the belief that consanguineous marriages are harmful to the offspring. The only justification for marriage under such circumstances lies in the belief that they are not harmful—at least, in particular cases. A question of fact is here involved, not mere opinion. Are they harmful or are they not Or if they are harmful in some cases and not in others, what are the conditions under which they are harmful? These are questions that might well be considered by your Committee on Eugenics.

The experience of breeders of animals would be especially helpful in this connection. It is extremely difficult to collect statistics upon a large scale regarding consanguineous unions among human beings, but a breeders' association could surely supply statistics concerning animals. We all know that the laws of heredity that apply to animals also apply to man; and statistics of in-breeding would be of great value if they could be so arranged as to throw light upon the effect of consanguineous unions in human beings. I understand that while breeders recognize an element of danger in consanguineous unions, and especially in continuous in-breeding for a number of successive generations, they constantly resort to in-breeding to perpetuate and intensify *desirable* characteristics. In fact, it is usually through in-breeding that thoroughbreds are produced; and it is chiefly through the prepotency of thoroughbreds that races of domestic animals are improved. If there are any conditions under which consanguineous unions would be of benefit to man they should be made known, so as to enable us to understand, certainly, what conditions are beneficial and what harmful, to the end that public opinion may be rightly guided in its treatment of this important subject.

We have statistics which indicate very clearly that consanguineous unions should not be contracted by defective persons, and the results obtained by Dr E. A. Fay* are specially significant in this connection. He shows that there is considerable liability to the production of deaf offspring where a deaf-mute marries a blood relative, even in cases where the original deafness was not congenital.

The statistics of the twelfth census† of the United States show that at least 4.5 per cent of the deaf of the country, and 4.5 per cent of the blind are the offspring of consanguineous marriages, but we do not know conclusively whether consanguinity in the parents *produces* the defective con-

* Marriages of the Deaf in America, by Edward Allen Fay. Published by the Volta Bureau, Washington, D. C., 1898.

† Special Report on the Blind and the Deaf in 1900. U. S. Census publication, Washington, D. C., 1906.

dition, or whether it simply *intensifies* a preëxisting tendency in the family.* The largest percentages of children of cousin marriages are found among the deaf who have deaf relatives (8.8 per cent), and among the blind who have blind relatives (9.5 per cent); whereas in sporadic cases the percentage falls to little more than 3 per cent—that is, about 3 per cent of the deaf who have no deaf relatives (3.3 per cent) and about 3 per cent of the blind who have no blind relatives (3.2 per cent) are the offspring of cousin marriages. This may mean a great deal or it may mean nothing at all. Should we find, for example, that 3 per cent of the population of the United States are the offspring of consanguineous unions there would be no proof that the consanguinity of the parents had anything to do with the production of the defect in these cases. Statistics showing the proportion of the whole population who are the offspring of consanguineous marriages are much needed, and the whole subject, I think, might very properly be investigated through the medium of the United States Census Bureau.

THE IMPORTANCE OF THE INFERIOR IS OVERRATED

In any large aggregate of individuals the vast majority will be of the average type of the race. Some few will be markedly superior and some few inferior.

An increase in the superior element seems to be a more important factor in producing improvement than a decrease in the inferior element. Even were we to go to the extreme length of cutting off entirely the reproduction of the inferior, this would not lead to an increase in the numbers of the superior, but on the contrary to a decrease; for some of the superior are the offspring of inferior parents, just as some of the inferior are the offspring of superior.

In the case of superior, average, and inferior persons all three classes would be reproduced in the offspring, but in different proportions. There would be a larger proportion of superior children among the offspring of the superior than of the average or inferior, and a larger proportion of inferior among the offspring of the inferior. The cutting off of the inferior would simply prevent deterioration by lessening the production of inferior offspring. It would not operate to cause an improvement by an increase of the superior element.

I am much struck by the thought that neither the quantity nor quality of the

* *The Deaf of the United States in 1900 from Census Table XLVII, omitting "not stated" cases relating to consanguinity of parents and Deaf Relatives.*

The deaf.	Numbers.			Percentage.	
	Total.	Parents cousins.	Parents not cousins.	Parents cousins.	Parents not cousins.
Total	77,550	3,911	73,639	5.0	95.0
Deaf relatives (*a* or *b*):					
Deaf relatives	24,723	2,171	22,552	8.8	91.2
No deaf relatives	52,827	1,740	51,087	3.3	96.7

The Blind of the United States in 1900 from Census Table XVIII, omitting "not stated" cases relating to consanguinity of parents and Blind Relatives.

The blind.	Numbers.			Percentage.	
	Total.	Parents cousins.	Parents not cousins.	Parents cousins.	Parents not cousins.
Total	55,307	2,449	52,858	4.4	95.6
Blind relatives (*a*, *b*, or *c*):					
Blind relatives	10,483	993	9,490	9.5	90.5
No blind relatives	44,824	1,456	43,368	3.2	96.8

superior element would be increased by cutting off the inferior element from reproduction, and I begin to suspect that students of eugenics have overrated the importance of legislative interference with the marriages of the inferior.

CELIBATE FELLOWSHIPS

A similar process of reasoning leads to the conclusion that the cutting off of the superior element from reproduction would retard the improvement of the race by lessening the production of superior offspring without injuring the community by increasing the production of the inferior elements.

The establishment of celibate fellowships in some of the oldest of the British universities is a case in point. The annual grants are sufficiently large to support the recipients in comfort, so as to enable them to devote their whole lives to some branch of literature, science, or art undisturbed by the necessity of earning a livelihood. Of course there is great competition to secure such prizes, and the finest and brightest young men are selected by competitive examinations to receive the fellowships. Thus young men of the most brilliant intellectual attainments are enabled to secure a support for life—*but only on the condition of celibacy*. The moment they marry they lose their fellowships. If there are many of these fellowships, and if the plan has been in operation for any considerable period of time, it might be well for students of eugenics to inquire whether the establishment of celibate fellowships in the past has had anything to do with the scarcity of young men of the highest intellectual caliber that is so much deplored in England today. Whether it has or has not, it would certainly seem more advisable in the interests of the community that such fellowships should be granted upon the condition of marriage rather than celibacy.

PREPOTENCY—THE KEY TO THE PROBLEM

Superior individuals on the whole have a larger proportion of superior offspring than the average of the race. Of course in cases where both parents were superior this prepotency is increased. It would be still further increased if all the four grandparents were superior, and if three or four generations of ancestors were all individually superior a thoroughbred would be produced. We are all familiar with the prepotency of the thoroughbred among animals. Indeed, as I have said before, it is mainly through the use of thoroughbreds that we improve our stocks of domestic animals. In the case of men and women who are thoroughbred in respect to the points of superiority, it is obvious that their descendants, spreading out among the population and marrying into average or inferior families, would prove prepotent over their partners in marriage in affecting the offspring, thus leading to an increase in the proportion of superior offspring produced from the average or inferior with whom they have mated. Thus not only would the proportion of superior offspring produced by the community as a whole be increased, but the level of superiority in the superior class would also be raised. There would thus be a general advance in the possession of desirable qualities all along the line from the lowest to the highest. Is not this what we mean by improvement of the species?

LEGISLATIVE RESTRICTIONS UPON MARRIAGE UNWISE

This result, I am inclined to believe, would follow from the simple process of promoting the marriage of the superior with the superior without resort to legislative restrictions upon marriage to reduce the production of the inferior.

Of course, such restrictions should be considered, but the moment we propose to interfere with the liberty of marriage we tread upon dangerous ground. The institution of marriage not only provides for the production of offspring, but for the production of morality in the community at large. This is a powerful reason why we should not interfere with it any more than can possibly be helped. There are other reasons, however, arising from a consideration of the rights possessed by individuals in a free community.

Among the inalienable rights recog-

nized by the Declaration of Independence are "life, liberty, and the pursuit of happiness." The community has no right to interfere with the liberty of the individual and his pursuit of happiness in marriage unless the interests of the community are demonstrably endangered. The happiness of individuals is often promoted by marriage even in cases where the offspring may not be desirable. The production of undesirable children is, of course, an injury to the community, and there may perhaps be cases where legal checks may be justified; but it should not be lost sight of that there are other checks that are equally if not more efficient that can be brought into play. If the conditions that produce undesirable offspring could be authoritatively stated, prudential restraints are apt to arise in cases where defective offspring are likely to be produced. Where the general intelligence of the individuals concerned is at fault, or their duty to the community is not fully understood or realized, another check comes into play far more efficient than any legal restriction. Public opinion is a great compelling force and few there are who can resist it.

Legal prohibition of marriage should only be resorted to in cases where there could be no manner of doubt that the community would suffer as the result of the marriage. Where doubt exists the community has no right to interfere with this most sacred and personal of all relations; and morality in the community would certainly be more promoted by affording the widest possible liberty of marriage than by restricting it. After all, the interests of the community are affected not so much by the fact of a marriage as by the production of undesirable offspring. The only reason why legislation against marriage should be considered at all lies in the fact that we cannot well legislate against the production of offspring. Unfortunately prohibition of marriage does not necessarily prevent the production of offspring. It is surely advisable that the children born in a community should have legal fathers and mothers as much as possible. Public opinion, and the desire of all persons to have healthy offspring, would, in my judgment, be a more powerful deterrent to the production of undesirable offspring than a compulsory process of law. Throw wide the gates of marriage, and where children are produced close tight the doors of divorce. Every child is entitled by nature to a father and mother; and no people should produce children who are not prepared to give them parental care for life. Without going to extremes, I would say that the interests of the community demand that we should make marriage easy and divorce difficult.

NEW BLOOD

The problem of improving a race of human beings is a most perplexing one to handle. The process of improvement must be slow where the forces concerned act from within and are not amenable to control from without. Under the best conditions it would require several generations to produce sensible results; but in the United States we have, in the new blood introduced from abroad, an important means of improvement that will act more quickly and that is eminently susceptible to control. All the nations of the world are today contributing elements to our population; and we have now, and now only, the opportunity of studying the process of absorption before it is complete. Why should not Congress provide for an ethnical survey of the people of the United States. We should have definite and reliable information concerning those foreign elements which are beneficial to our people and those which are harmful.

The grand spectacle is presented to our eyes of a new people being gradually evolved in the United States by the mingling together of the different races of the world in varying proportions. It is of the greatest consequence to us that the final result should be the evolution of a higher and nobler type of man in America, and not deterioration of the nation.

To this end the process of evolution should be carefully studied, and then controlled by suitable immigration laws tending to eliminate undesirable ethnical elements, and to stimulate the admission of elements assimilated readily by our population and that tend to raise the standard of manhood here.

THE CARNEGIE INSTITUTION

THE Yearbook of the Carnegie Institution for 1907 just issued contains a summary by President Woodward of the five years' work of the institution, and an outline of its future plans. Many important investigations, too expensive or extraordinary for other institutions, and requiring years of consecutive work, have been begun. The benefits thus guaranteed to mankind cannot be measured.

The institution expended $702,534.39 in 1907 out of its endowment income for its projects of research and for publication and administration. The aggregate receipts thus far from interest on endowment, etc., have been $2,891,370.66, and of this sum in six years there has been disbursed $2,683,073.16.

President Woodward gives the following list of the larger projects, or departments of work, and of the directors conducting the researches in the departments, or laboratories:

Botanical Research: D. T. MacDougal
Economics and Sociology: Carroll D. Wright
Experimental Evolution: Chas. B. Davenport
Geophysical Laboratory: Arthur L. Day
Historical Research: J. F. Jameson
Marine Biology: Alfred G. Mayer
Meridian Astrometry: Lewis Boss
Nutrition Laboratory: Francis G. Benedict
Solar Observatory: George E. Hale
Terrestrial Magnetism: L. A. Bauer.

To this list may be added the work in horticulture carried on in the main by Mr Luther Burbank, but in a supplementary way also under the auspices of a committee consisting of the President and the heads of the three departments of biological research.

The minor projects and labors of research have been along the lines of:

Anthropology	History
Archeology	Literature
Astronomy	Mathematics
Bibliography	Meteorology
Botany	Paleontology
Chemistry	Philology
Economics	Phonetics
Engineering	Physics
Exploration	Physiology
Geology	Psychology
Geophysics	Zoölogy

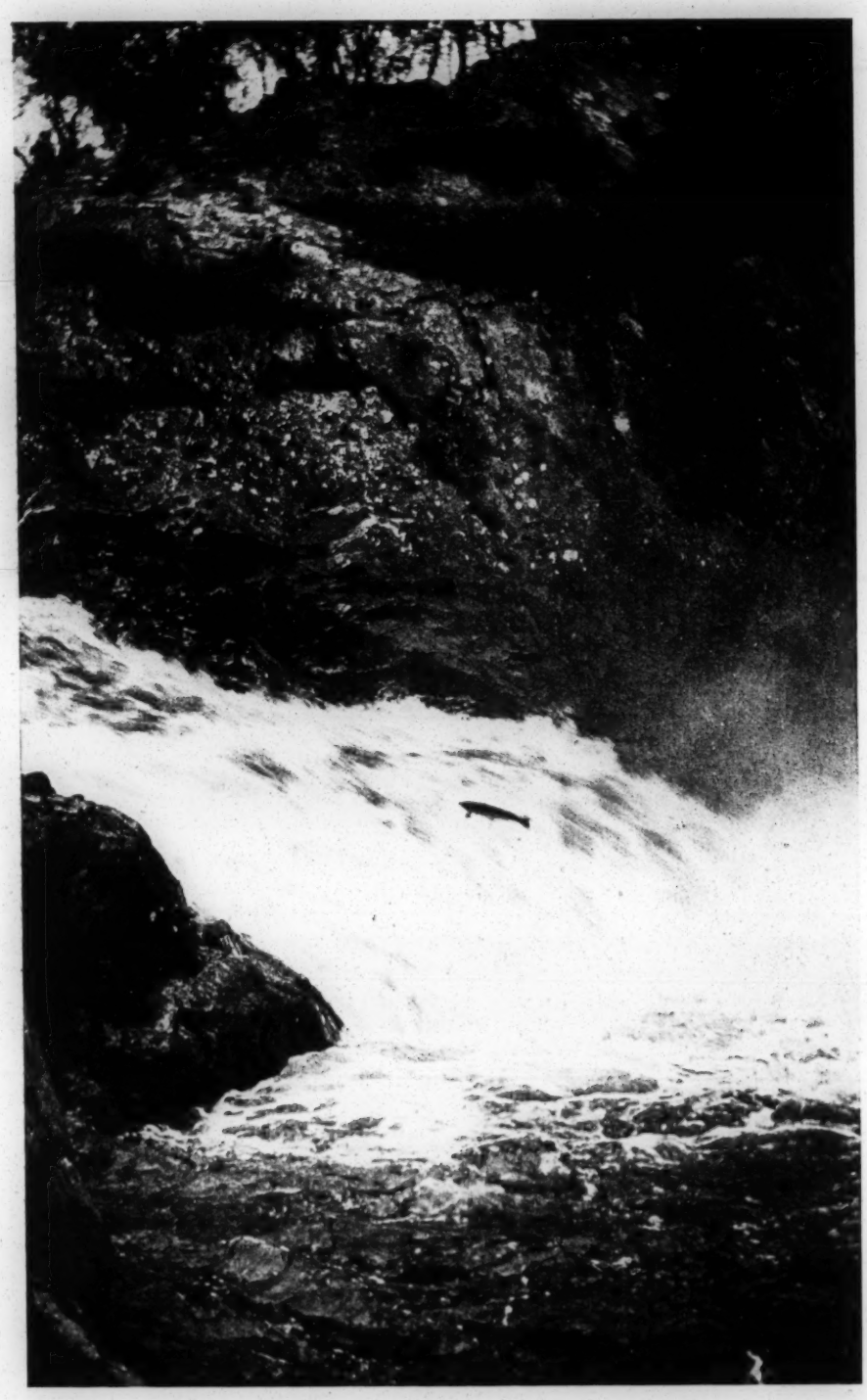
Among the notable publications of the year is No. 81, in which Director MacDougal gives an account of the production of a new species of plant by an application of chemical fluids to the parent plant seeds during the period of germination. This remarkable achievement must be regarded as one of the noteworthy advances in modern biology.

In its magnetic survey of the Pacific Ocean up to September 1, 1907, the *Galilee* has traversed nearly 50,000 miles in the Pacific Ocean along courses where few magnetic observations have been made hitherto. Complete measurements of magnetic declination, dip, and intensity were secured at intervals of 200 to 250 miles along these courses, as well as at numerous points on islands and at prominent ports. All of the results of this extensive survey available in March of the past year were furnished to the U. S. Navy Department and incorporated in a magnetic chart issued in May last by that department for the benefit of mariners. Important errors in previous charts, amounting in cases to as much as 5° in magnetic declination along some main routes of transportation, were thus corrected.

The Department of Economics is making a study of our immigrant population.

A JUMPING SALMON

THE picture on the following page is an enlargement of a "snapshot" taken by Dr Richard D. Harlan, of The George Washington University, in September, 1907, of a salmon trying to leap up the falls of the River Shinn, on Mr Andrew Carnegie's estate at Skibo, Scotland. The fish were about 2½ feet long. On that particular day some of them made the effort at frequent intervals, of a minute or two, to get up the falls, which were about 12 feet high. None of them were successful on that occasion because of the great volume of water. The fish in this picture struck fully 6 feet above the level of the lower stream, only to be hurled back. The picture has been enlarged without any retouching.



SALMON CAUGHT IN THE ACT OF TRYING TO LEAP UP THE FALLS OF THE SHINN

FUN FOR THE BOYS AND GIRLS IN THEIR FAVORITE SCHOOLGROUND, OSTRE ANLAEG, COPENHAGEN, DENMARK

This series of illustrations (pages 126–140) of school children the world over are from stereographs by Underwood & Underwood, of New York, and are copyrighted by them

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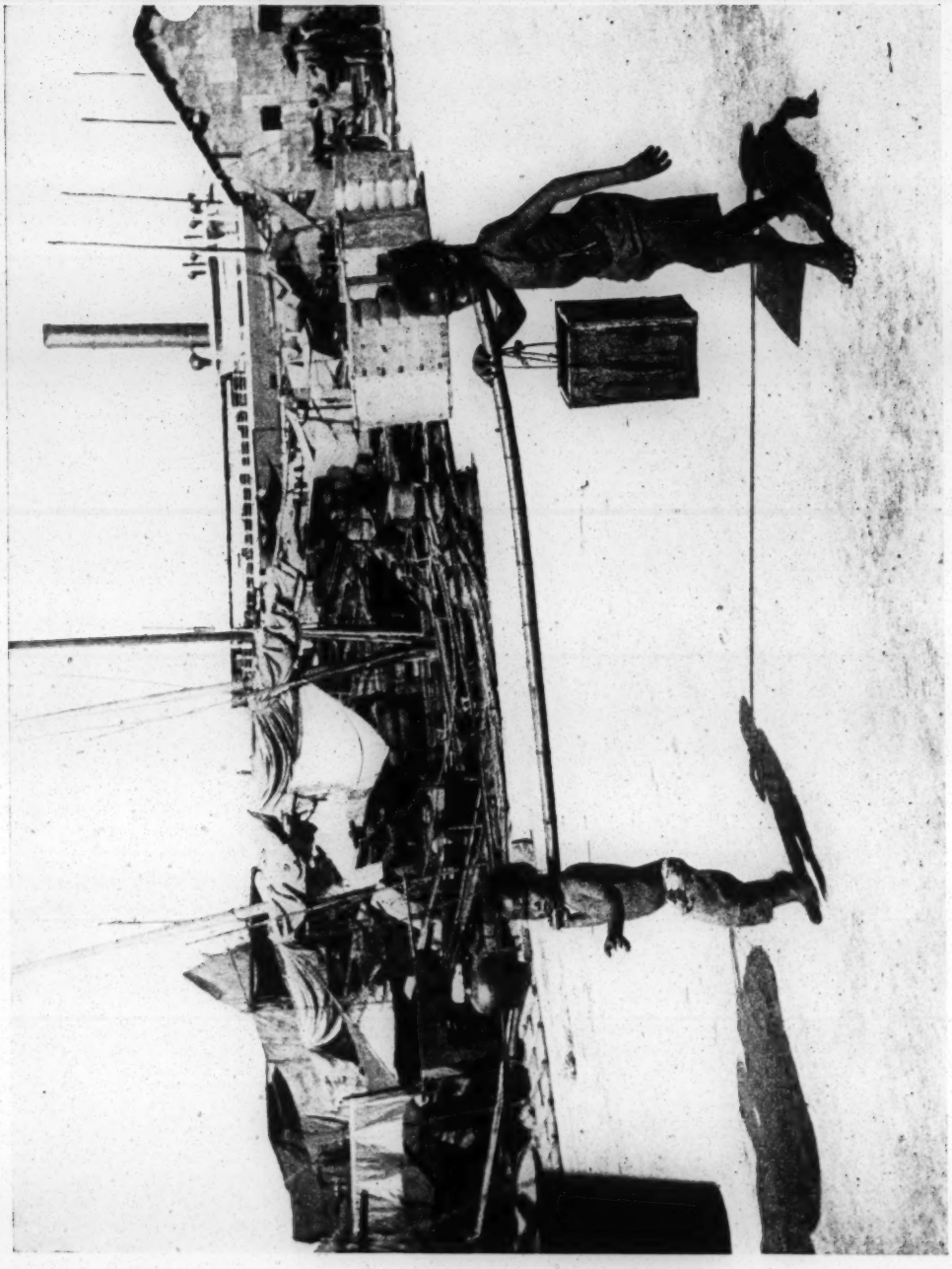
BOYS AND GIRLS OF AVE MARIA CHARITY SCHOOL, GRANADA, SPAIN



INFANT COOLIES IN CHINA

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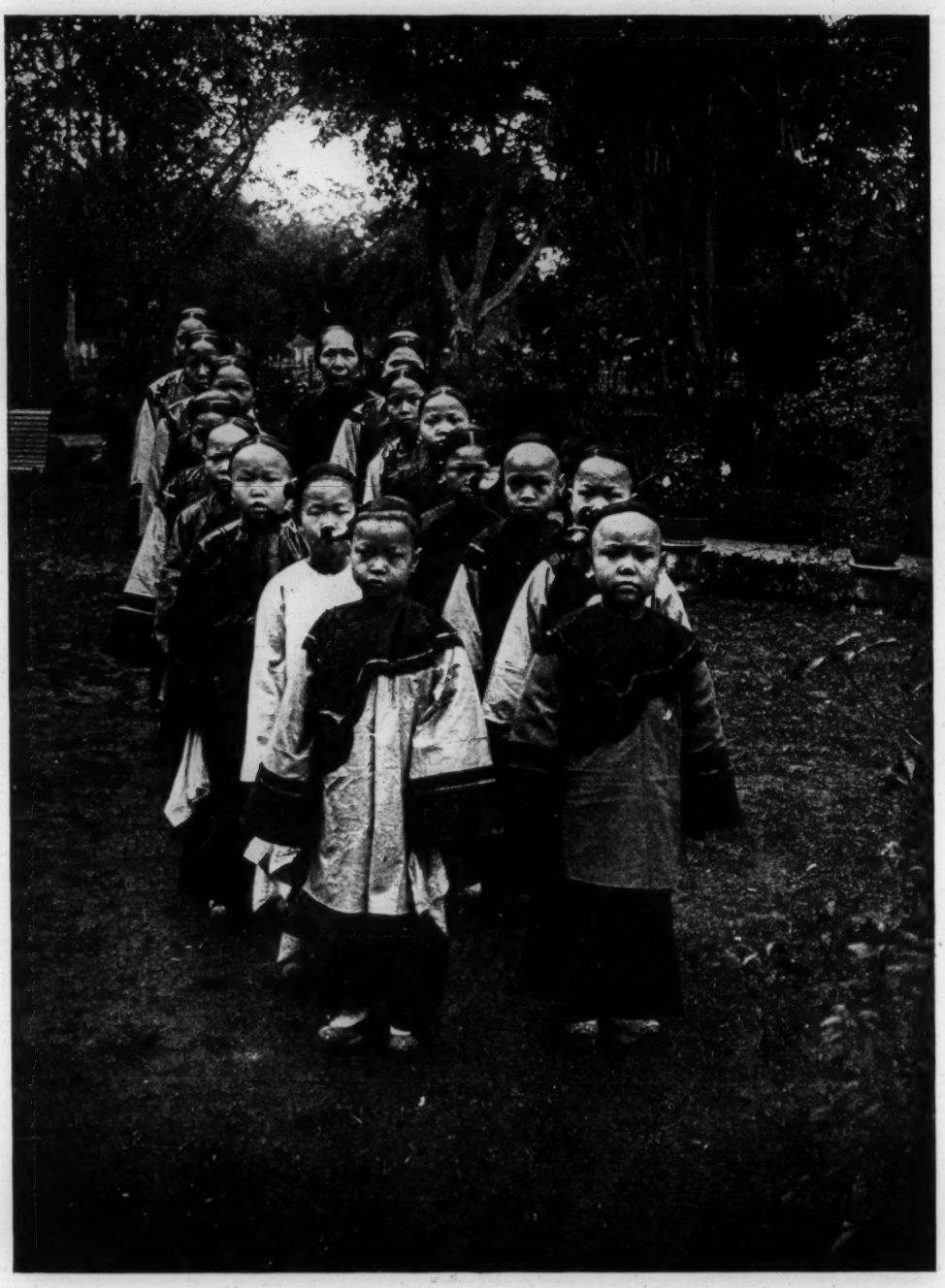

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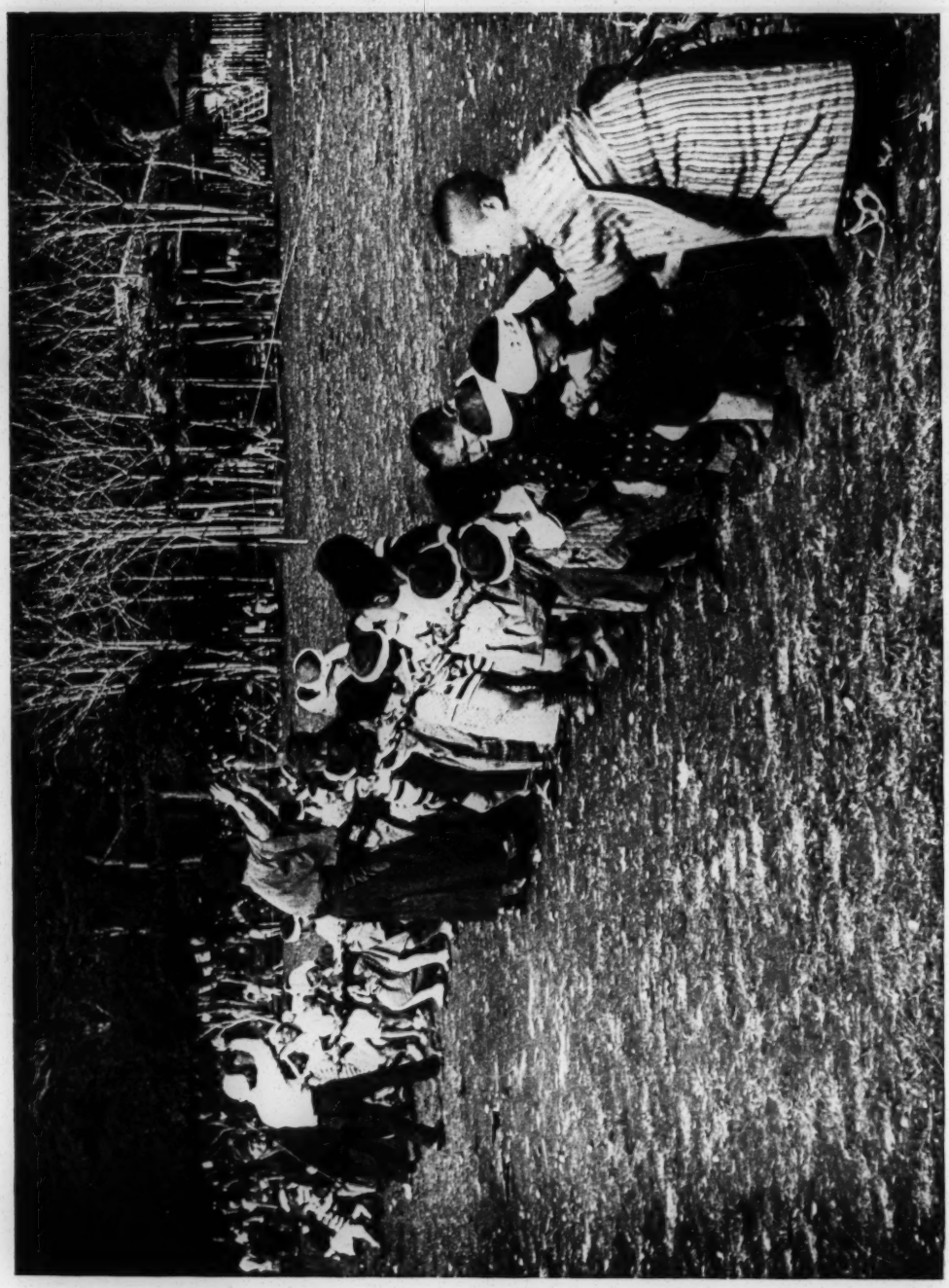
PUPILS OF A MISSIONARY SCHOOL IN CHINA



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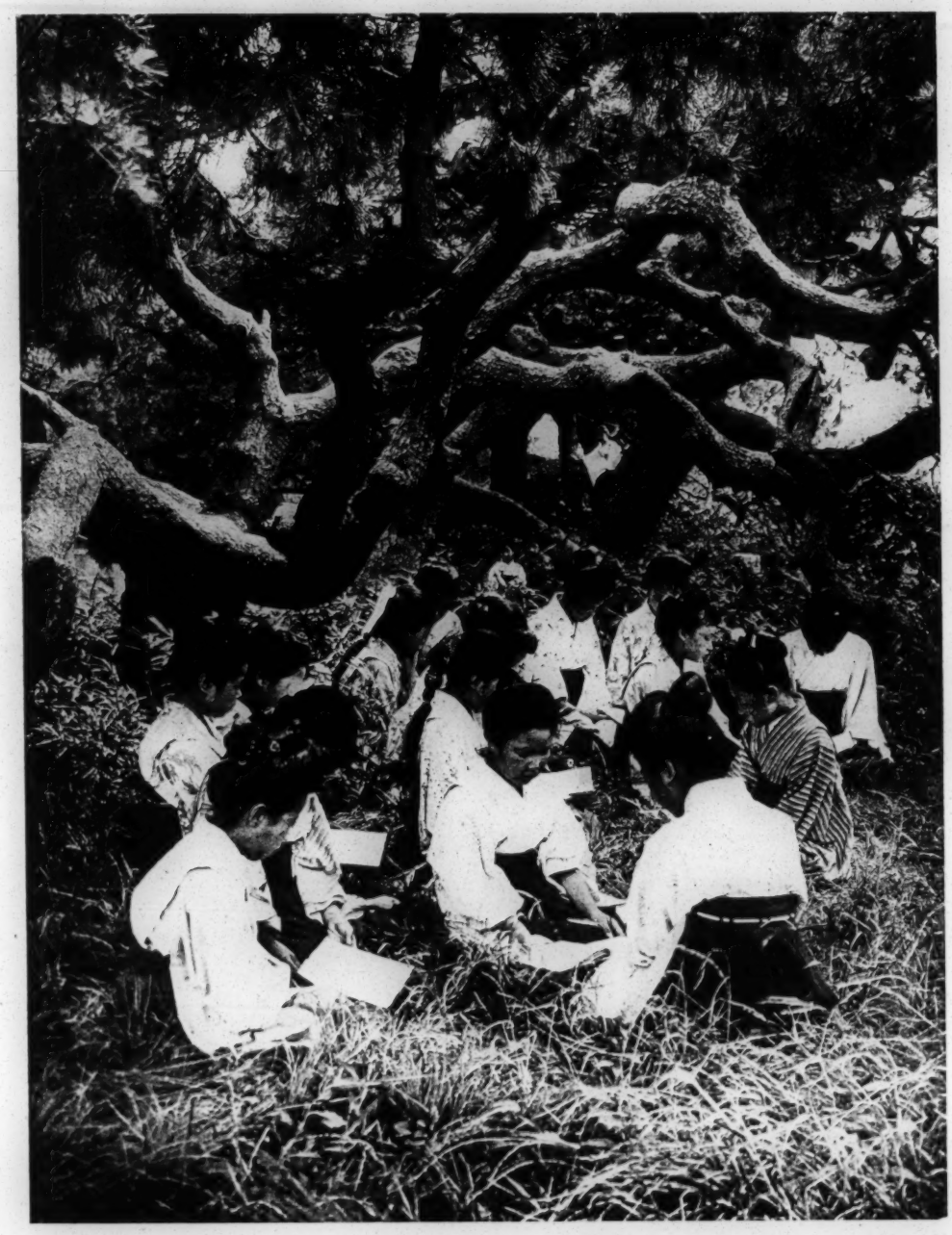
LITTLE JAPANESE SCHOOL-BOYS ENGAGED IN A LIVELY TUG OF WAR



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GIRLS UNDER THE TREES, TOKIO, JAPAN

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A GROUP OF BURMESE CHILDREN

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INDIA OF TOMORROW

Handsome school boys of Amritsar at the Golden Temple beside the Holy Tank

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A GROUP OF SCHOOL-GIRLS IN KAPIOLANI PARK, HONOLULU, HAWAII

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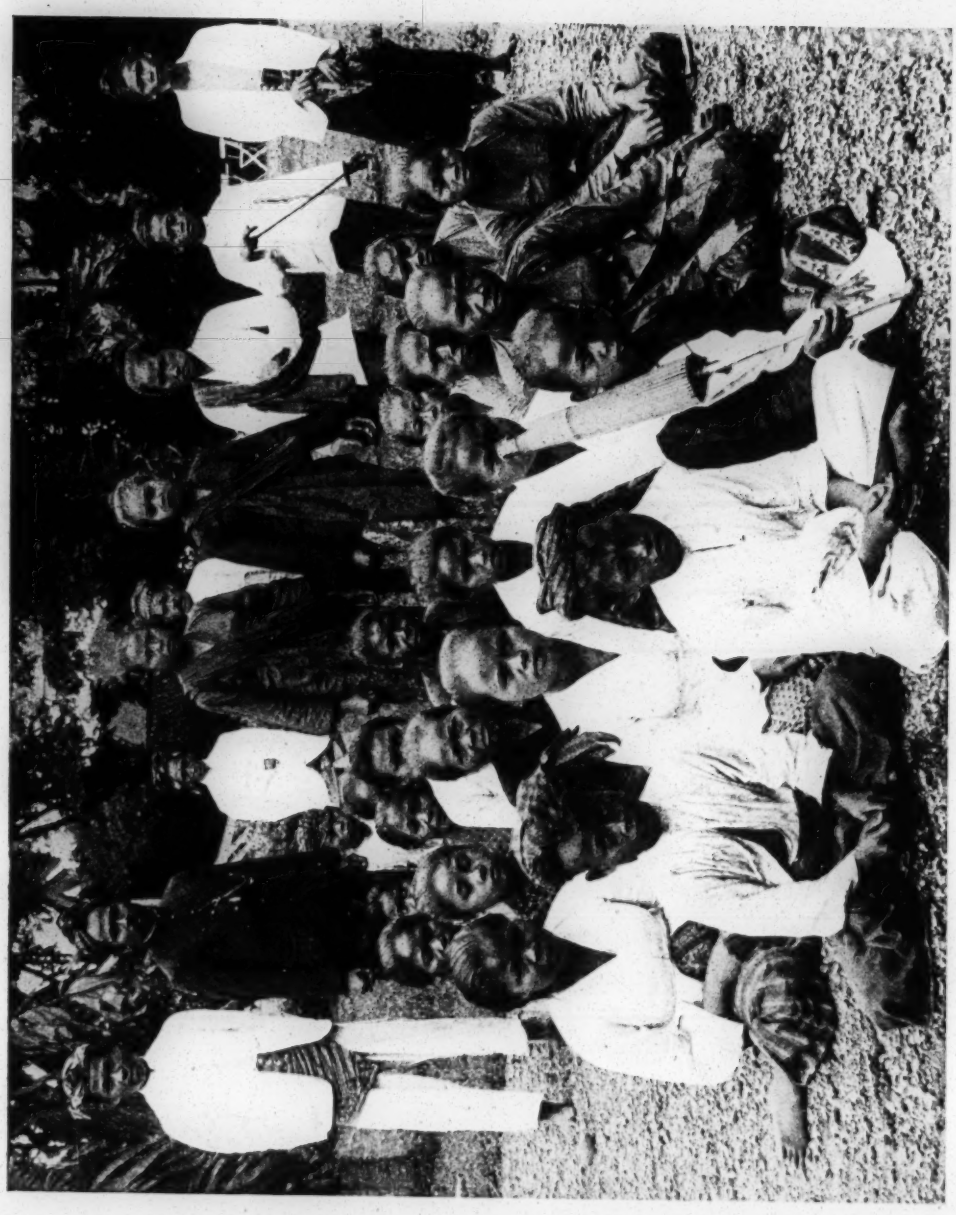
SCHOOL IN CEYLON, SHOWING PUPILS, TEACHER, AND SCHOOL-HOUSE



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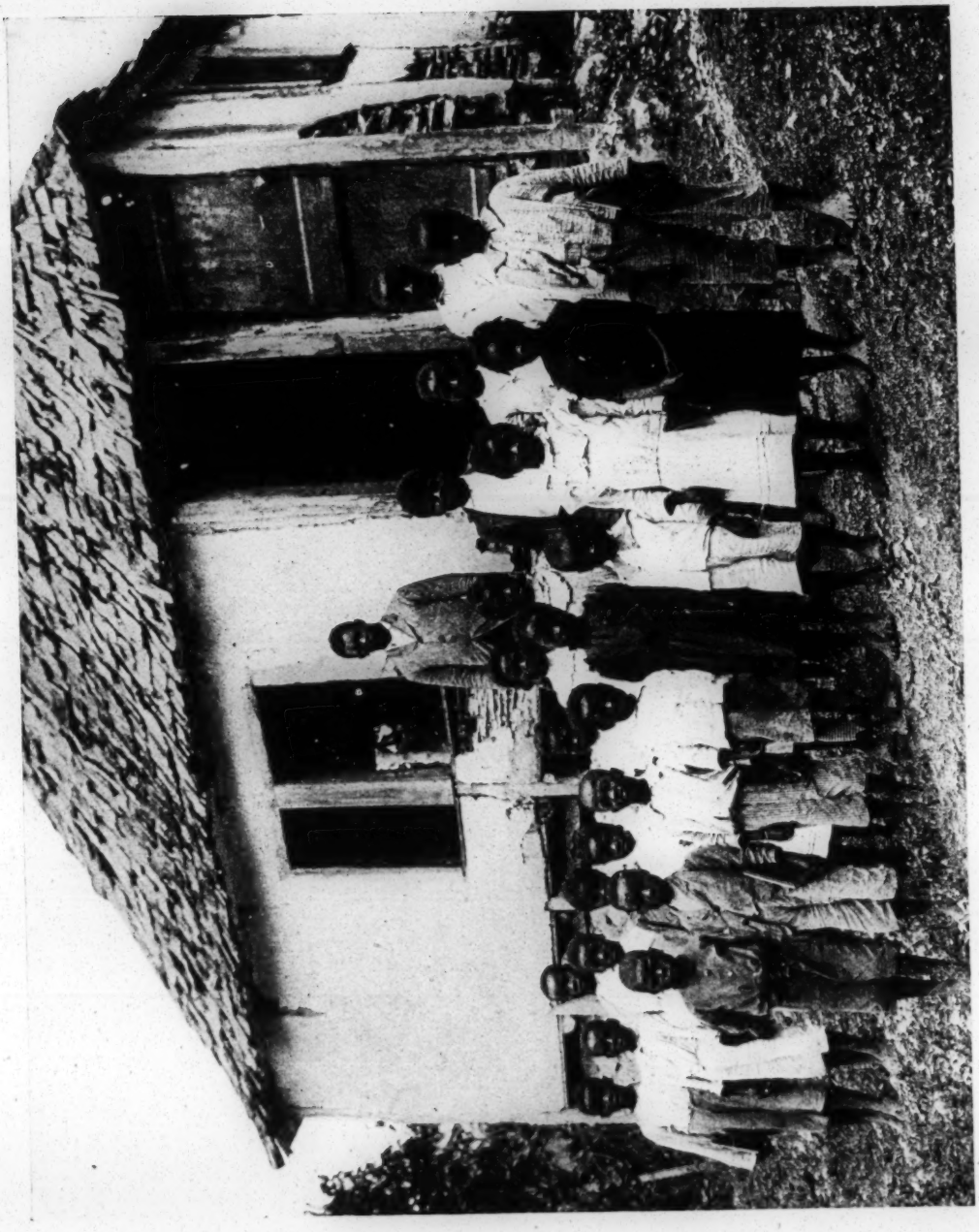
JAVANESE AT GAROET—JAVANESE WOMEN AND CHILDREN



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WEST INDIAN PICKANINNIES, SCHOLARS, AND TEACHER BEFORE A SCHOOL-HOUSE IN JAMAICA

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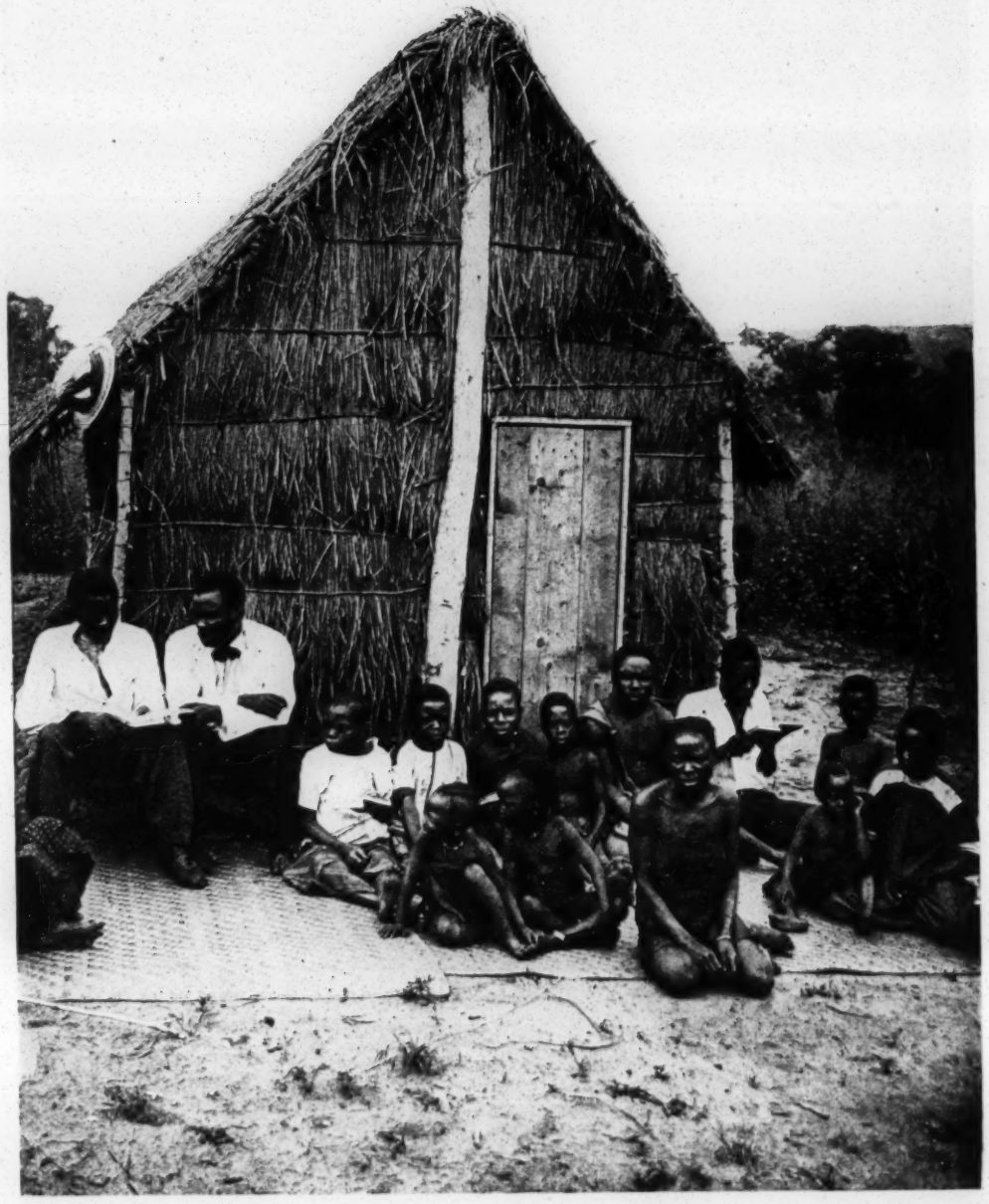
UNITED STATES SCHOOL ON INDIAN RESERVATION AT THE SECOND MESA OF THE MOKI COUNTRY.



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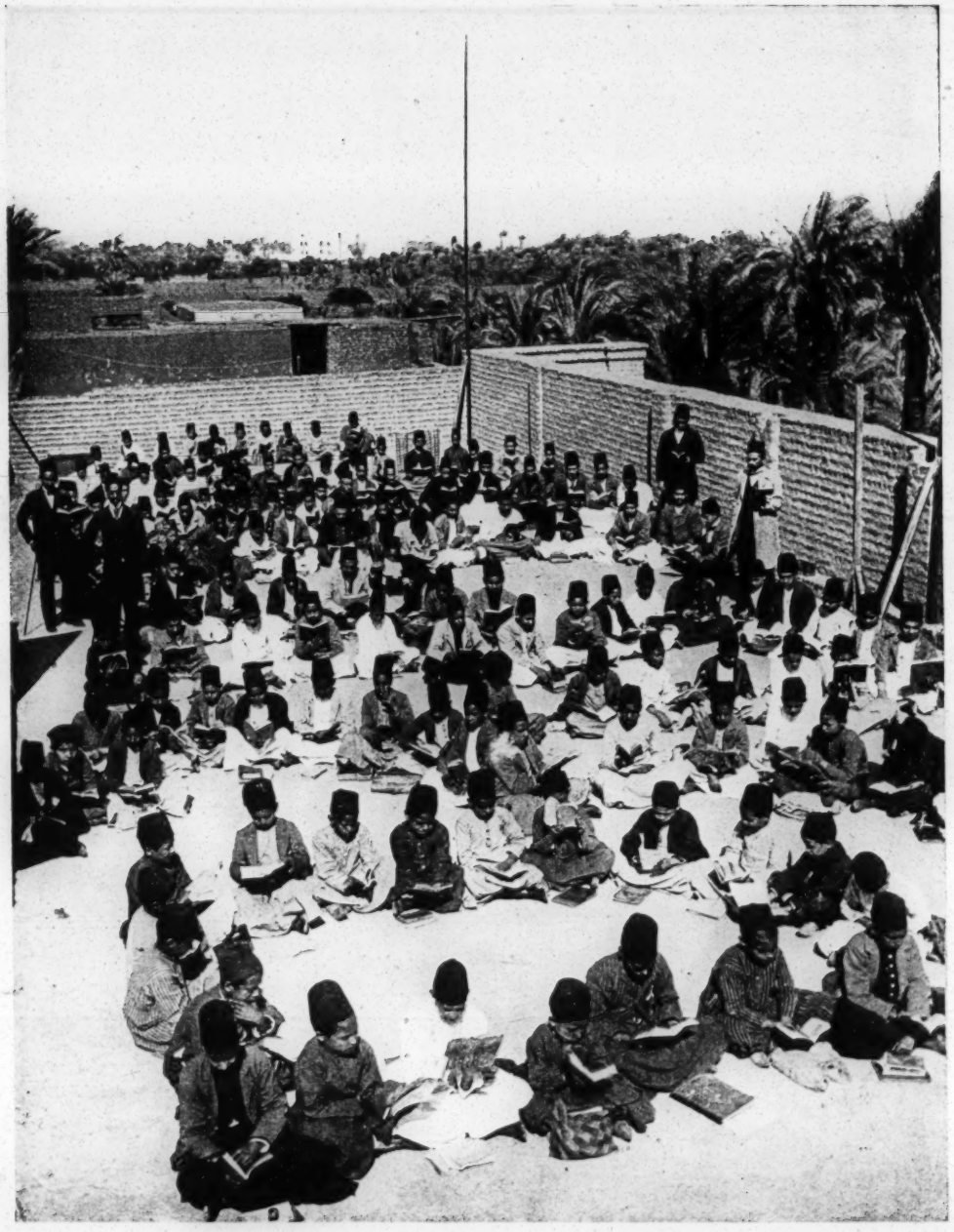
MEETING AT MISSION SCHOOL AT NIBUNZA BOBUNA VILLAGE, CONGO



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BOYS STUDYING ON THE HOUSETOP AT ASSIOUT, EGYPT

TEN YEARS IN THE PHILIPPINES

The following article has been abstracted from the report of the Secretary of War, Hon. William H. Taft, on his recent trip to the Philippines and the opening of the Philippine National Assembly. The report contains a review of what the United States have done in the Philippine Islands since our acquisition of them nearly ten years ago. The Americans are driving Asiatic cholera, bubonic plague, and smallpox, which formerly caused thousands and thousands of deaths annually, out of the Philippine Islands as thoroughly as they have freed Panama from yellow fever. President Roosevelt, in transmitting the report to Congress, could rightly say:

"No great civilized power has ever managed with such wisdom and disinterestedness the affairs of a people committed by the accident of war to its hands. . . . Save only our attitude toward Cuba, I question whether there is a brighter page in the annals of international dealing between the strong and the weak than the page which tells of our doings in the Philippines."

PEACE prevails throughout the Philippines today in a greater degree than ever in the history of the islands, either under Spanish or American rule, and agriculture is nowhere now impeded by the fear on the part of the farmer of the incursion of predatory bands. A community consisting of 7,000,000 people, inhabiting 300 different islands, many of whom were in open rebellion against the government of the United States for four years, with all the disturbances following from robber and predatory bands which broke out from time to time, due to local causes, has been brought to a state of profound peace and tranquillity in which the people as a whole are loyally supporting the government in the maintenance of order. This is the first and possibly the most important accomplishment of the United States in the Philippines.

Our national policy is to govern the Philippine Islands for the benefit and welfare and uplifting of the people of the islands and gradually to extend to them, as they shall show themselves fit to exercise it, a greater and greater measure of popular self-government. One of the corollaries to this proposition is that the United States in its government of the islands will use every effort to increase the capacity of the Filipinos to exercise political power, both by general education of the densely ignorant masses and by actual practice, in partial self-government, of those whose political capacity is such that practice can benefit it without too great injury to the efficiency of government. What should be emphasized in the statement of our national policy is that we wish to prepare the Filipinos for *popular* self-government.

THE NATIONAL ASSEMBLY IS DEVISED TO TRAIN THE EDUCATED CLASSES IN SELF-GOVERNMENT WHILE THE IGNORANT MASSES ARE BEING EDUCATED

The organization of the National Assembly is one of the great steps in the education of the Filipino people for complete self-government.

I do not for a moment guarantee that there will not at times be radical action by the Assembly, which cannot meet the approval of those who understand the legislative needs of the islands, but all I wish to say is that the organization and beginning of the life of the Assembly have disappointed its would-be critics and have given great encouragement to those who were responsible for its extension of political power.

The Assembly has shown a most earnest desire, and its leaders have expressed with the utmost emphasis their intention, to labor for the material prosperity of the Philippines and to encourage the coming of capital and the development of the various plans for the improvement of the agriculture and business of the islands which have commended themselves to those in the past responsible for the government there. In other words, thus far the Assembly has not manifested in any way that obstructive character which those who have prophesied its failure expected to see.

In arguing that the Philippines are entirely fit for self-government now, a com-

mittee of educated Filipinos once filed with the civil governor a written brief in which it was set forth that the number of "ilustrados" in the islands was double that of the offices—central, provincial, and municipal—and therefore the country afforded two "shifts" of persons competent to run the government. This, it was said, made clear the possibility of a good government if independence was granted. The ignorance of the remainder of the people, admitted to be dense, made no difference. I cite this to show of how little importance an intelligent public opinion or an educated constituency is regarded in the community and government which many of the educated Filipinos look forward to as a result of independence.

THE FILIPINO IS THE ONLY MALAY RACE THAT IS CHRISTIAN

No one denies that 80 per cent of the Filipino people are densely ignorant. They are in a state of Christian tutelage. They are childlike and simple, with no language but a local Malay dialect spoken in a few provinces; they are separate from the world's progress. The whole tendency under the Spaniards was to keep them ignorant and innocent. The Spanish public-school system was chiefly on paper. They were for a long time subject completely to the control of the Spanish friar, who was parish priest and who generally did not encourage the learning of Spanish or great acquaintance with the world at large.

The world owes to the Spanish friar the Christianization of the Filipino race. It is the only Malay or oriental race that is Christian. The friars beat back the wave of Mohammedanism and spread their religion through all the islands. They taught the people the arts of agriculture, but they believed it best to keep them in a state of innocent ignorance. They feared the influence of world knowledge. They controlled the people and preached to them in their own dialects. They lived and died among them.

The friars left the people a Christian people—that is, a people with western ideals. They looked toward Rome, and Europe, and America. They were not like the Mohammedan or the Buddhist, who despise western civilization as inferior. They were in a state of tutelage, ripe to receive modern western conceptions as they should be educated to understand them. This is the reason why I believe that the whole Christian Filipino people are capable by training and experience of becoming a self-governing people. But for the present they are ignorant and in the condition of children.

THE PROBLEM CAN BE SOLVED BY THE EDUCATION OF ONE GENERATION

There is no real difference between the educated and ignorant Filipinos that cannot be overcome by the education of one generation. They are a capable people in the sense that they can be given a normal intellectual development by the same kind of education that is given in our own common-school system. Now they have not intelligence enough to exercise the political franchise with safety to themselves or their country; but I do not see why a common-school education in English, with industrial teaching added, may not make the children of these people capable of forming an intelligent public opinion needed to sustain a popular government if, at the same time that the oncoming generations are being educated in schools, primary and industrial, those who are intelligent are being given a political education by actually exercising the power of the franchise and actually taking part in the government.

The Philippine government, however, has not funds enough to educate in primary and industrial schools all the present generation of school age, and unless some other source of funds than governmental revenues is found it will take longer than a generation to complete the primary and industrial education of the common people. Until that is done, we ought not to lift our guiding hand from the helm of the ship of state of the Philippine Islands.

The language selected for the schools is English. It is selected because it is the

language of business in the Orient, because it is the language of free institutions, and because it is the language which the Filipino children who do not know Spanish are able more easily to learn than they are to learn Spanish, and it is the language of the present sovereign of the islands. The education in English began with the soldiers of the American Army, one of whom was detailed from each company to teach schools in the villages which had become peaceful. When the Commission assumed authority it sent to the United States for 1,000 American teachers, and after the arrival of these pioneers in the islands a system of primary schools was inaugurated together with normal schools.

There are engaged in the teaching of these schools at present 717 permanent American teachers and 109 temporary appointees, and all of these are paid out of the central treasury.

6,000 FILIPINOS TEACHING ENGLISH

The 6,000 Filipino teachers who are now teaching English have received their English education from our normal schools or our American teachers. Their number is growing, and they represent and are the most valuable educational asset we have acquired in working out our school system. The Filipino insular teachers are drawn from graduates of normal schools and also from the students sent by the government and at the expense of the government to the United States to be educated there. Forty-six of these students have recently returned from the United States and have been appointed as insular teachers at salaries ranging from 840 to 960 pesos per annum. We are not able to educate as they should be educated more than a half of the youth of school age in the islands. The government, while contributing to the maintenance of high schools in each province, is devoting its chief attention to the spread of primary education, and in connection with primary education, and, at its close in the intermediate schools, to industrial education. Primary and industrial education carried on until the child is 14 or 15 years old is thought to be the best means of developing the Filipino people into a self-sustaining and self-governing people, and the present government has done all that it has been possible to do in developing and maintaining a proper system for this purpose.

ALREADY MORE FILIPINOS SPEAK ENGLISH THAN SPEAK SPANISH

The influence of the primary instruction in English is shown throughout the islands by the fact that today more people throughout the islands, outside of Manila and the large cities, speak English than speak Spanish. At times, as already intimated, a discordant note is heard in the suggestion that the American government is seeking to deprive the Filipino of his native language. As his native language is really 15 or 16 different dialects, this does not seem a great deprivation.

Should Congress be anxious to facilitate and hurry on the work of redeeming the Philippine Islands and making the Filipino people a self-governing community, it could take no more effective step than a permanent appropriation of two or three millions of dollars for ten or fifteen years to the primary and industrial education of the Filipino people, making it conditional on the continued appropriation by the Philippine government of the same amount to educational purposes which it has devoted and is now devoting annually to that purpose. The influence of the educational system introduced has not only been direct in the spread of education among the younger of the present generation, but it has also been an indirect means of convincing the Filipino people at large of the beneficent purpose of the American government in its remaining in the Philippine Islands and of the sincerity of its efforts in the interest of their people.

FILIPINO CADETS AT WEST POINT

Section 36 of the act of Congress approved February 2, 1901, referring to Philippine Scouts, provides that—

"When, in the opinion of the President,

natives of the Philippine Islands shall, by their services and character, show fitness for command, the President is authorized to make provisional appointments to the grades of second and first lieutenants from such natives, who, when so appointed, shall have the pay and allowances to be fixed by the Secretary of War, not exceeding those of corresponding grades of the regular army."

As it is thought that better results will be obtained if a few young Filipinos, especially selected, be appointed to the United States Military Academy with a view to their being commissioned officers of scouts upon graduation, I strongly recommend that Congress, by appropriate legislation, authorize the appointment of seven young Filipinos, or one for about every million of inhabitants of those islands, as cadets at the Military Academy at West Point. This action on the part of Congress would, in my judgment, tend to further increase the zeal and efficiency of a body of troops which has always rendered faithful and satisfactory services.

THE DEATH RATE OF AMERICANS IN THE PHILIPPINES NO GREATER THAN IN OUR SOUTHERN CITIES

There is always present in every picture of Philippine progress as painted by those who have not carefully investigated the facts a somber background of a baneful climate, making it impossible for the American or European to live in health and strength in the islands for any length of time. It is true that the islands are in the tropics, and that the variations in temperature are only about a third as much in extent as in the temperate zone; but, for a tropical climate, that of the Philippines is exceptionally comfortable and healthful. The monsoons blow six months from southwest across the islands and six months from the northeast, so that they are constantly windswept. This makes a radical difference between the climate of the islands and that of the lowlands of India, for instance. The last two decades, especially the latter, have taught us much in respect to tropical diseases, their causes, their proper treatment, and the best method of avoiding them. This was one of the most valuable results of the Spanish war.

In his address as president of the Philippine Medical Association, in March, 1905, Dr John R. McDill, who came first to the islands as a leading army surgeon and who left the army to carry on a most successful practice in Manila, said:

"We have come to esteem to the utmost the climate which so effectually guards many of you against the too strenuous life and which is almost ideal eight months in the year, even in Manila. Our professional experience has proven that, excepting some intestinal disorders which we are rapidly preventing and curing and a limited amount of epidemic infectious diseases, there is nothing unusual about the kind or amount of disease encountered here, or its successful treatment when hospital care is available. The surgeon's work has fully demonstrated that ideal wound healing and convalescence after operation is as much the rule here as anywhere in the world. We physicians also know that and appreciate that the dread diseases of childhood so prevalent at home are rare here, and that of all the ills, particularly among women, from real bodily ailments to a poor complexion, for which the climate is usually blamed, the great majority are hereditary or acquired, were brought here by the patient, and often aggravated by careless and unhygienic living. For old people and children the climate is an earthly Elysium. . . . With the improved and constantly improving conditions of living, we believe that almost all will agree that by observing the normal and moral life healthy Americans can live about as long here and enjoy as good health and do as much good and hard work, more than three-fourths of the year, as we could in the home land."

The death rate among American soldiers in the Philippines for the last year was 8.5 per thousand, and the previous year 8.65. General Wood reports that the size of the sick report cannot be properly charged to the climate; that, taken

as a whole, the reports for the years indicate a decided improvement in health conditions, and that the men leaving the islands after a regular tour of more than two years present a far better appearance than those of the incoming.

The death rate among American civilians in Manila for the fiscal year ending June 30, 1907, was 5.59 per thousand, a reduction from the previous year. The death rate among Filipinos this year in Manila was 36.9 per thousand and among Spaniards 15.84, both reductions from the previous year.

During the decade of our stay in the islands the conditions of life for Americans have steadily bettered. We have become acquainted with hygienic methods of living, and the death rate of Americans of the same social condition in the Philippines is certainly not greater than in the cities of the Southern States, and is, as we have seen, very much less than that among Filipinos.

WE HOPE TO MAKE THE FILIPINOS LARGER AND STRONGER PHYSICALLY

If the United States is to continue its governmental relations with the Philippines for more than a generation and its business and social relations indefinitely, the fact that Americans can live healthful lives in the Philippines is important of itself; but I have cited these statistics and this expert opinion to show more than this—I believe that it has an important bearing upon another kind of progress possible among the Filipino people, and that it opens another important field of education for the American government to cultivate in the islands.

No one can be in the Philippines long without realizing that as a race the Filipinos are small of stature, slight of frame and flesh, and with small powers of resistance to epidemic diseases. It has been supposed that because of their nativity the Filipinos were not subject to the malarial, intestinal, and dysenteric troubles that afflict Americans and Europeans, and that measures taken to avoid or cure such troubles in the case of the foreigner were unnecessary and superfluous with the Filipinos. Recent investigations of a systematic kind, carried on by keeping comparative statistics of all the official autopsies made in the islands, seem to show that the assumption that the Filipinos are immune from the forms of disease I have mentioned is without foundation. The autopsies of 100 cases showed in a great majority the germs of malaria, of amœbic dysentery, and that microbe of the so-called "lazy" disease of Porto Rico known as the "hookworm." It is true that the diseases were not active or acute, but their presence in the system of course weakened the constitution of the subject and could easily explain his anæmic condition, his smallness of stature, and small powers of resistance. Malaria, of course, is produced or at least transmitted by the mosquito, while amœbic dysentery and the "lazy" disease are water-borne and proceed directly from the miserable sources of water supply in most Filipino towns. Proper precautions can avoid all these, or at least can greatly reduce the number of victims.

In Manila, 60 per cent of all infants born die during the first year of their lives, and there is no reason to believe that infant mortality in other parts of the islands is less. This frightful percentage is brought about by ignorance and neglect of the mothers in feeding their babies. There are very few, if any, milch cows in the islands, and the little ones are fed with all sorts of impossible things. They die generally of a lack of nourishment. There is no reason why, if the mothers were correctly taught and proper infant food were brought within the reach of the poor, this awful rate of infant mortality might not be reduced. Not only is there an actual loss of life which might be avoided, but the babies which live through such treatment and nourishment are not apt to make strong men and women, but are likely to become victims of anæmia and other diseases mentioned, as shown in the autopsies I have referred to.

I do not think it is unjust to the Spanish régime in the Philippines to say that very little, if any, attention was paid to

sanitation according to modern methods. In the city of Manila and in the other large towns of the islands the American military medical authorities, who were the first to assume responsibility for the health of the islands, found the same utter disregard of the proper rules for the disposition of house sewage that was found in Habana. Thousands, yes, tens of thousands, of Filipinos were carried off year after year by a peculiarly virulent type of smallpox.

In Manila, in Cebu, and in Nueva Caceres, respectively, were leper hospitals, but in each the management was inefficient and the care of the inmates poor. More than this, no supervision was exercised to isolate lepers not in hospitals. Sometimes the poor creatures were driven out of villages by popular riots and herded together with no proper food and no shelter. The contact of lepers with the people of course only increased the number of cases of the dread disease.

In 1885 or 1886 the islands were visited by an epidemic of cholera, and the prostration of the people of Manila and the Philippines, due to the rapid spread of the scourge, beggared description. In Manila the deaths were 1,000 or more a day from that cause alone for a number of weeks. The trade proximity of Manila, Iloilo, and Cebu to China, India, Java, Burma, and the Straits Settlements makes the danger of transmitting tropical and other infectious diseases very much greater.

Quarantine in Spanish times was lax. The American Army medical authorities took hold of the matter of sanitation in their usual vigorous way and made much progress in the matter of quarantine and in correcting the glaringly unsanitary conditions in Manila. But it remained for the civil government to effect a thorough organization of a health department which could do permanent good.

The introduction of sanitary methods by law among the people has given rise to more dissatisfaction and greater criticism of the government than any other one cause. The truth is that the people have to be educated in the effectiveness of such methods before they can become reconciled to them, and the work of the health department since the beginning of the civil government, in 1901, has been obstructed, first, by the inertia and indifference of the people in respect to the matter, and, second, by their active resistance to affirmative restraints upon them necessary to prevent disease.

SMALLPOX AND ASIATIC CHOLERA STAMPED OUT

The fight against smallpox has been so successful that in the past year not a single death from it occurred in Manila, and in the provinces of Cavite, Batangas, Cebu, Rizal, Bataan, La Laguna, and La Union, where heretofore there have been approximately 6,000 deaths per year, not one was reported. In the few places in other provinces where smallpox appeared it made little headway. More than 2,000,000 vaccinations against smallpox were performed last year, and vaccination is being carried on so that it will reach every inhabitant of the islands.

In 1902 Asiatic cholera appeared. The loss the first year by reason of the methods introduced was much less than it had been fifteen or sixteen years before, but great difficulty was encountered in putting into force the health regulations, and a futile attempt was made to establish quarantine between localities in the islands. Since that time a better system of isolation and stamping out the disease in the locality where it appeared has been followed, and it is gratifying to note that, although the dread disease appeared each year, it was finally brought to an end on November 27, 1906, and the authorities now feel that the people have been so thoroughly roused to the best methods of treating the disease that any local reappearance of it can be readily suppressed.

In 1902 or 1903 the bubonic plague appeared in the islands. This has been suppressed by the isolation of all persons suffering from the disease and the de-

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struction of plague-infected rats, so that during the last year there were no cases of bubonic plague whatever.

LEPROSY ALSO BEING ERADICATED

When the Americans first began government in the Philippines it was reported that leprosy was so widely extended in the islands that there were probably from 25,000 to 50,000 lepers to be cared for. After many unsuccessful efforts a leper colony has finally been established at Culion, a healthful and attractive island between Panay and Palawan, to which all the lepers of the islands are now being gradually removed. The number probably does not exceed 3,000. The course pursued is to take each province separately and by thorough investigation of the reported cases of lepers determine those of true leprosy and to remove them thence to the colony of Culion. The experiment at first was a doubtful one because of the objection of the lepers to being taken so far away from their homes, and some of the friends of lepers made vigorous objections to this course. After the removal of the first 500, however, and when they found how comfortable and agreeable life at Culion was, the objections ceased. Leprosy as a disease usually does not directly kill its victims, but it so weakens the powers of their resistance that the rate of mortality from other causes among lepers is very high. The system of isolation and withdrawing lepers from the thickly populated communities has been at once justified by the reduction in the number of new cases. The number of known lepers in the archipelago on September 1, 1905, was 3,580; on June 30, 1907, it was 2,826, a decrease of 654, due to the death of the known lepers without any spread of the disease, as had been the case in previous years and under different conditions. The policy of removal of lepers is one which can only be carried out gradually and has been applied only to a part of the provinces, but it will probably be completed in three or four years, when all the lepers will be removed to Culion, and the effect of this isolation will certainly be to reduce the infection of healthful persons with the awful disease to a minimum.

RAILROADS IN THE PHILIPPINES

In my last annual report I set forth in detail the concessions granted for the construction of railroads in Luzon, Panay, Cebu, and Negros, and showed that within five years we might expect that, instead of a single line of railway 120 miles in length, which was all that we found when we occupied the islands, we would have a system with a mileage of 1,000 miles. Work has gone on in full compliance with the terms of the concessions of the two companies.

Only one of these companies took advantage of the provision for the guaranty of bonds, and they have built about 40 miles of road and have earned, under the terms of the concession, the guaranty of $973,000 of bonds, which has already been signed and delivered by the Philippine government. Of course, in this financial panic these companies are likely to have difficulty in securing investors in their securities.

The roads as constructed have been well constructed, and are admirably adapted to resist the climatic conditions in the islands. There is no reason in my judgment why these roads, when constructed, should not pay a reasonable percentage upon the investment. It is of the utmost difficulty to secure the coming of capital to the islands, and it would greatly aid us if the dividends earned by these roads were very large. In the Orient two-thirds of the income of railways comes from passenger earnings and one-third from freight. Of course, the railroads are very essential to the agricultural interests of the country and will directly affect the amount of exports of agricultural products, so we may count on a steady increase in the freight receipts from the moment of their beginning operation. As I say, however, the chief hope for profit in the railways is in the passenger traffic.

In the three Visayas, in which the railroads are to be constructed, the density of

population is about 160 per square mile, whereas the average population per square mile in the United States in 1900 was but 26. The Island of Cebu has a population of 336 per square mile, or a greater density than Japan, France, Germany, or British India. It is, therefore, reasonable to suppose that the passenger earnings on these railroads will be very large.

THE FILIPINO LABORER IMPROVING

It was anticipated that the labor problem would be a difficult one to solve in the construction of these roads. This has not proved to be true. The Philippine labor has shown itself capable of instruction, and by proper treatment of being made constant in its application. Of course, the prices of labor have largely increased, but the companies constructing the roads have found it wise to increase wages, and thereby secure greater efficiency. Even with increased wages the cost of unit of result is less in the Philippines in the construction of railways than it is in the United States.

I do not hesitate to prophesy that during the next twenty-five years a development will take place in the agricultural and other business of the Philippine Islands which will be as remarkable in its benefits to the United States and the Philippine Islands as was the development of Alaska during the last ten or fifteen years. Hope of this is not what has actuated the government in pursuing the policy that it has pursued in the development of the islands, but this is as inevitable a result as if it had been directly sought, and perhaps the absence of selfishness in the development of the islands is a greater assurance of profitable return than if business exploitation by the United States had been the chief and sole motive. The growth in the production of hemp and other fiber products, in cocoanuts, in rubber and many other tropical crops, and in peculiar manufactures of the islands may be looked forward to with certainty.

The city of Manila has not been given autonomous government. It is under the control of a municipal board of five persons appointed by the central government, and is governed, therefore, as Washington or the City of Mexico is governed. In the proper improvement of Manila some six or eight millions of dollars had to be expended, and much business experience and foresight were required to build the new water works and the new sewer system, to repave the streets, to canalize the esteros, or creeks, to organize an effective police force and a new fire department. It was thought that it would not be safe to intrust the conduct of such important business matters to a body selected by the electorate of Manila for the first time. The city of Manila has been well governed. Very large sums of money have been expended in most extensive improvements, and not the slightest scandal or dishonesty has been charged in any of the city administration. It has offered a most useful model for other municipalities in the islands to follow and has lent engineers, policemen, and firemen to other towns to help the latter to better organization.

There is no city in the world better governed than Manila. The streets are well cleaned, are well policed, there is a most excellent fire department, the parks are being enlarged and improved, the street-car system is as good as anywhere, and with the improvements in the water supply the sewerage system and esteros or canals, which are now under foot and part of which are quite near accomplished, the face which the Filipinos turn toward the world in the city of Manila will be a most pleasing one.

A BEAR HUNT IN MONTANA

By Arthur Alvord Stiles

Topographer, U. S. Geological Survey

WITH the end of the hunting season in the Far West there comes to light a true and exciting bear story—one that well might have made the bravest hunter look to his safety, or even have thrilled the sportsman spirit of President Roosevelt himself.

The incident occurred last September in the forest of northwestern Montana. The party consisted of Dr Charles B. Penrose, a well-known physician of Philadelphia, the victim of bruin's ferocious attack, and his two brothers, Spencer Penrose, of Colorado Springs, and Senator Bois Penrose, of Pennsylvania, now in Washington. The party had spent the early part of the season exploring a section of the Lewis and Clark Forest Reserve, where trails were to be found and where travel with the pack-horses was comparatively easy. Toward the end of the summer, however, Senator Penrose desired to see a part of the country hitherto unsurveyed and without trails or passways of any kind. It is a section of high and rugged mountain peaks, snowfields, and living glaciers, wholly uninhabited except by the wild animals, and wellnigh inaccessible save in the dead of winter, when some adventurous soul of doubtful judgment might make his way thither on snowshoes.

As it happened, a small party of topographical surveyors of the U. S. Geological Survey was then penetrating into this God-forsaken region, carrying with them their pack-train of mules, camp equipment, and map-making instruments. This was the first pack outfit of any kind to enter into the territory. Senator Penrose and his brothers joined the government party, and by them were conducted well up among the snow-capped peaks of the range.

Continued bad weather having stopped the work of the surveyors and made all mapping impossible, the writer, who was chief of the government party, offered to take Senator Penrose out for a hunt. The Senator and his younger brother, however, were tired out with the long and difficult journey to the government camp, so Dr Penrose, who had endured the hard climb better than his brothers, volunteered to accompany me to a distant glacier basin, where they expected to find big game. The saddle horses were left at the head of this basin, and, little knowing of the fate that awaited them, the two men separated.

I had just sighted a fine buck deer and was on the point of creeping away from it so that Dr Penrose might come and kill it, when I heard three shots in rapid succession. I gave no special heed to the reports, which came from the other side of the ridge, and was about turning to shoot the deer myself, when I heard two more shots; a moment more and another report rang out. Immediately becoming alarmed, I ran back in the direction from whence the shots came. I suppose I reached the doctor in about five or ten minutes. As I came around a mass of broken boulders I saw Dr Penrose wandering aimlessly around in the canyon bed. He had no gun. His hat was gone, his coat torn off, and his trousers rent. Blood poured from his head and neck, and he gripped his left arm in his crimson right hand. When I reached him he murmured piteously, "Water, water." I ran and brought water in my big sombrero from the other side of the rocks. He drank it like a thirsty horse, and I thought I saw part of it run out through a gash in his cheek. Then he said: "Stiles, I am all in; I have had a fight with a bear."

With signal cloth I hurriedly began to tie up the worst of his wounds, and as I did so the picture and the bleeding man told me the story. A few rods down the gulch lay a grizzly cub, so large as to appear full-grown, except to the careful observer. Near by was the huge carcass

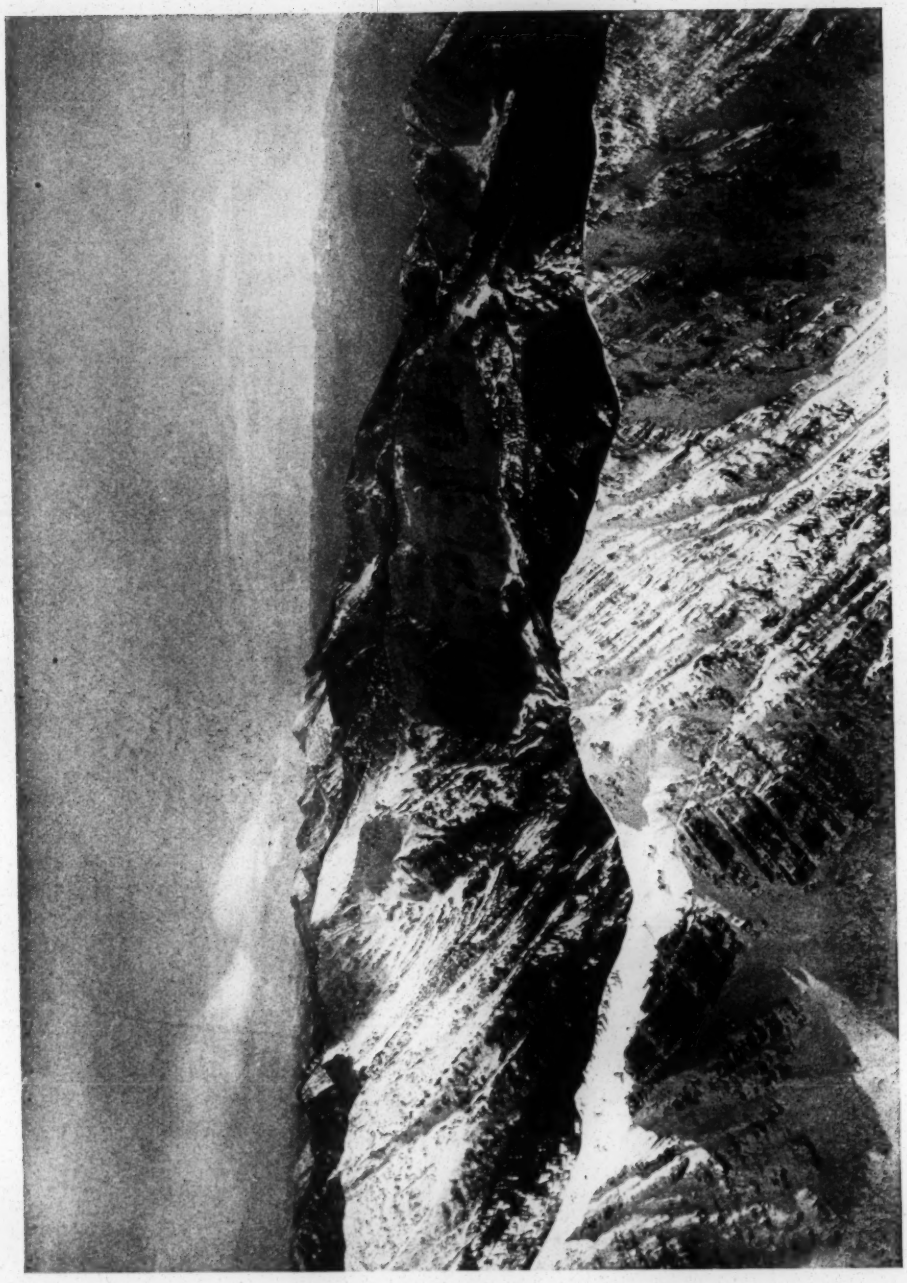


Photo by Robert H. Chapman and H. L. Baldwin

CHARACTERISTIC SCENE IN NORTHWESTERN MONTANA

Swan range looking south from west spur of Baptiste Peak

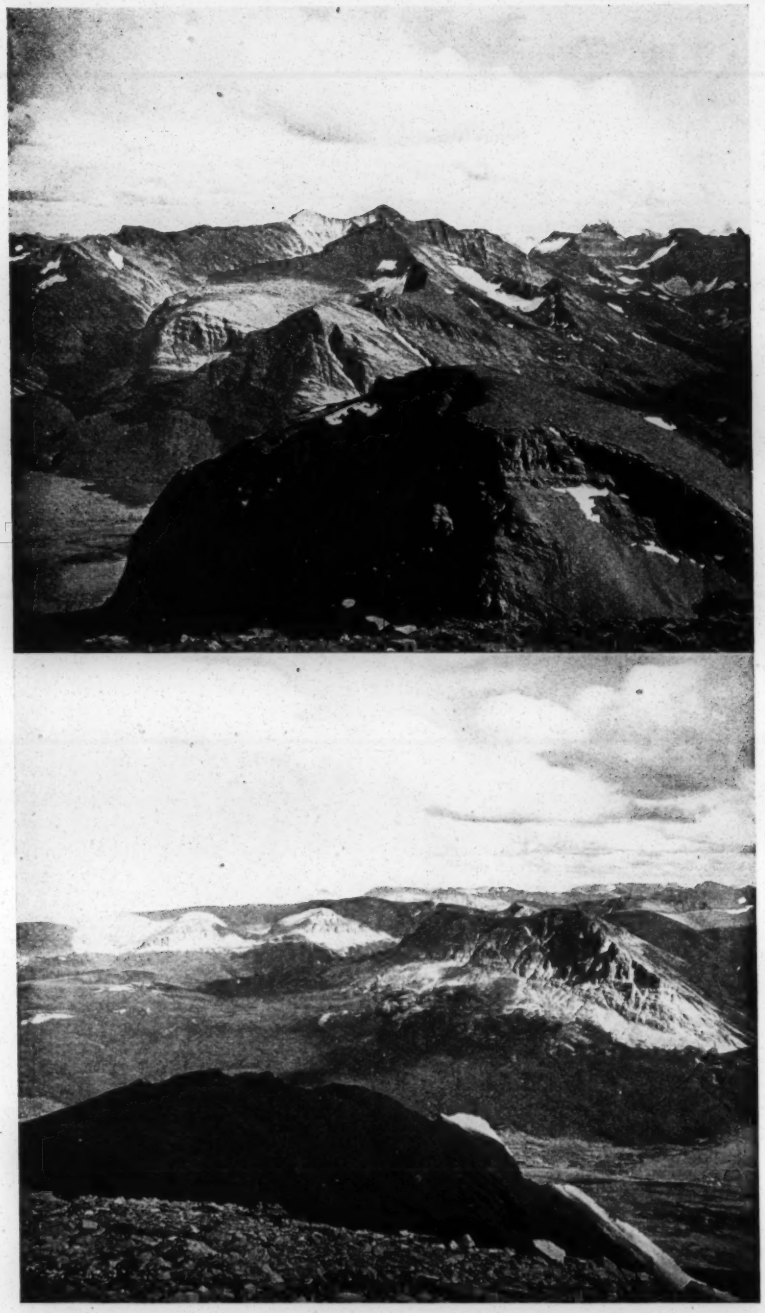
of a mother grizzly, and near her the doctor's Mauser rifle, cast aside and empty. All was plain now. In his excitement Dr Penrose had not noted that the bear which his first three shots had so promptly slain was yet a young cub, whose grief-stricken and enraged mother might then be making her way from the rocks and brush to avenge the death of her offspring. Going down to examine his prize, he placed his rifle on a rock, fortunately not far away.

He was stooping over the dead cub when there came from behind him a rush and an awful cry. He turned and saw the mother bear coming upon him, then not sixty feet away. With almost superhuman presence of mind Dr Penrose caught up his Mauser again and fired two shots into the enraged beast. Instantly he took from his pocket his last remaining cartridge, worked it into the rifle, and sent a third steel-jacketed bullet into the onrushing bear. Swift and sure as were the little bullets, the bear's fury was not checked in time. With one stroke of her paw she sent him into the gulch, eight feet below. She sprang down after him and caught him in her mouth and shook him as a cat might shake a mouse. She dropped him. Again she caught him up, his face between her glistening tusks. She tore his scalp; his eyes narrowly escaped. A tusk penetrated into his mouth from the side of his cheek; another tore open his throat. There were five gaping wounds in his chest. His thigh bore an awful, irregular tear, and the flesh hung in ragged pieces from the wound, half as wide as your hand. His left wrist was twisted and broken, and the bones stuck out through the quivering flesh. The bear tried once more to shake her half-dead victim, but she sickened with her own awful wounds, and, staggering, fell dead at his feet.

The little Mauser bullets, fired a moment before, had finally had their deadly effect, and by his steady nerve and accurate aim Dr Penrose had saved his own life. Had the beast lasted another half minute the doctor would have been with his fathers, and the little cub's death would have been avenged. But the heroic mother had fought to the last, and now, with her dead baby, lay quiet and still forever.

Recovering sufficiently, the bleeding man sat up and began to take stock. As he meditated thus, there came a new adversary. In actual fact, or in the suffering man's delirous fancy—I have never known which—a third bear bounded out of the brush from another direction. The doctor's heart sank; he could make no resistance now; he hoped that death might come quickly. The new enemy approached to close quarters, and, walking around, snarled and growled savagely, yet was evidently undecided what to do. Then, with a cry of mingled rage and fright, it dashed off down the gulch and was lost in the forest.

The journey back to camp was difficult and dangerous, but the suffering doctor, who now began to realize his frightful condition, was bearing up bravely. Wrapping my big cow-boy slicker around him, I managed to get him on my horse, and we turned back to the camp, where we had left the Penrose party. My faithful horse did his duty nobly, as we climbed and stumbled along for two hours without a trail, at last reaching the teepees at nightfall. The unexpected sight of the wounded and bleeding doctor somewhat demoralized the group of waiting men, and after some delay a pine-knot camp-fire was made for light, and with the patient lying at full length on the ground I began my surgical operations, assisted by such much-needed instruction as the doctor, in his awful pain, could give me while the work progressed. I applied antiseptics and placed bandages, all of which happily he had with him in a small emergency case. Finally the broken wrist was reached. It was agreed that I should remove the protruding bones, the nervy patient thinking he could endure the pain of the operation without anesthetics. I disinfected the little knives and appliances and the last operation began. The pain was awful. With one agonized groan the man gave up for the first time. We held a hurried conference. The wrist would have to be left as it was, and we bound it up once more in signal cloth. It



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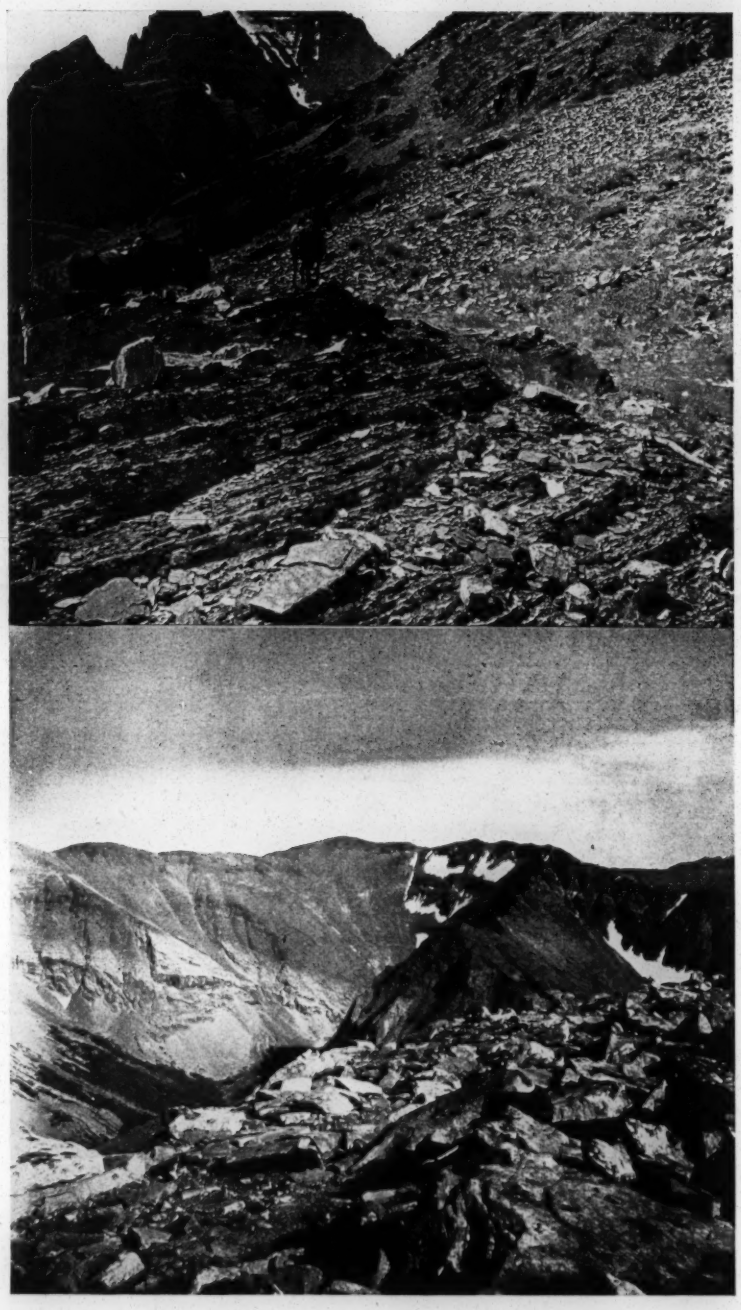


Photos by Robert H. Chapman and H. L. Baldwin

PACK-TRAIN CROSSING THE RANGE

View from Kootenai Mountain, looking south

was one o'clock in the morning when I finished my amateur surgery. Thoroughly distracted by the sight of their brother's suffering, Senator Penrose and Spencer withdrew to another tent, and I lay down near Dr Penrose to wait for dawn.

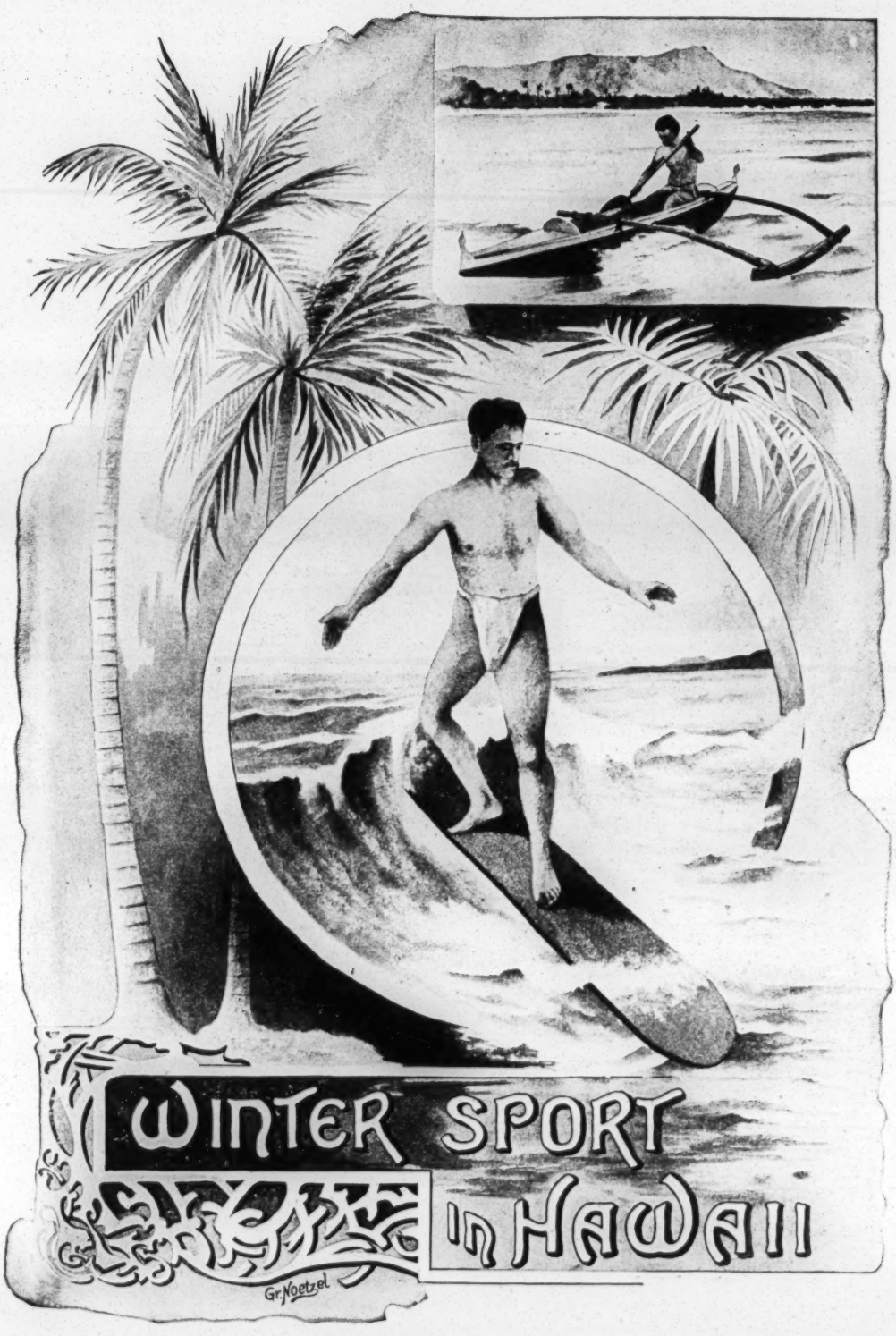
My life on the frontier has been full of trying episodes, but oh, that night! How would we get Dr Penrose out of the mountains? I dare not guess how many times I asked myself that question. As the gloomy hours dragged by I listened to the heavy breathing of the man whose nerve and fortitude I had already come to admire, now asleep and groggy with the morphine injected to stop his unbearable suffering.

To go back the way we came up would mean two days and a 600-foot climb on foot. He could not last. By the second day we would be packing out a dead body. Yet there was no other route. The situation was desperate. In the lonely flickering of that camp-fire I meditated, and my sympathies went out to that wounded man. As the case presented itself at that moment success in guiding the party to the railroad meant the doctor's life, if not his comfort; failure meant death, simply. Before that welcome dawn had come I decided to run a hazard. We would take Dr Penrose to the railroad by an unheard of route. Providence might point the way.

At dawn the little caravan started. Again the big black horse carried the almost helpless doctor, Senator Penrose and Spencer walking on either side to steady their brother through the tight places. The faithful guide, Bill Hague, lead the extra "packs," and two young men from the Survey party, Malcolm Force, of Montclair, New Jersey, and Billy Kemeys, of Washington, D. C., worked as axemen. Thus, for eleven hours, we climbed down, down, down, five miles through the forest and jungle, cutting our way as we went. At dark we dropped through to the railroad, completely exhausted, but safe. Our route had proved successful. I could not have cut another tree or broken another brush, and my two Survey boys had stood by me like men.

Quickly we conducted Dr Penrose to a lonely section-house two miles down the track, where the Great Northern Limited was flagged, and he was taken away to Minnesota, where, three days later, he was operated upon by the surgeons at the Mayo Hospital. Since then he has retired to his country home near Philadelphia. Though his recovery is not yet complete, his progress has been very remarkable.

As a memento of the encounter with the bear, Dr Penrose has presented the writer with a beautiful Mauser rifle, imported from the Krupp works at Essen, Germany. In the stock of the rifle is set a little silver nameplate which bears the simple inscription: "Arthur Stiles, from C. B. Penrose."



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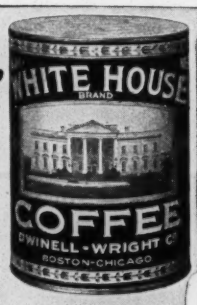

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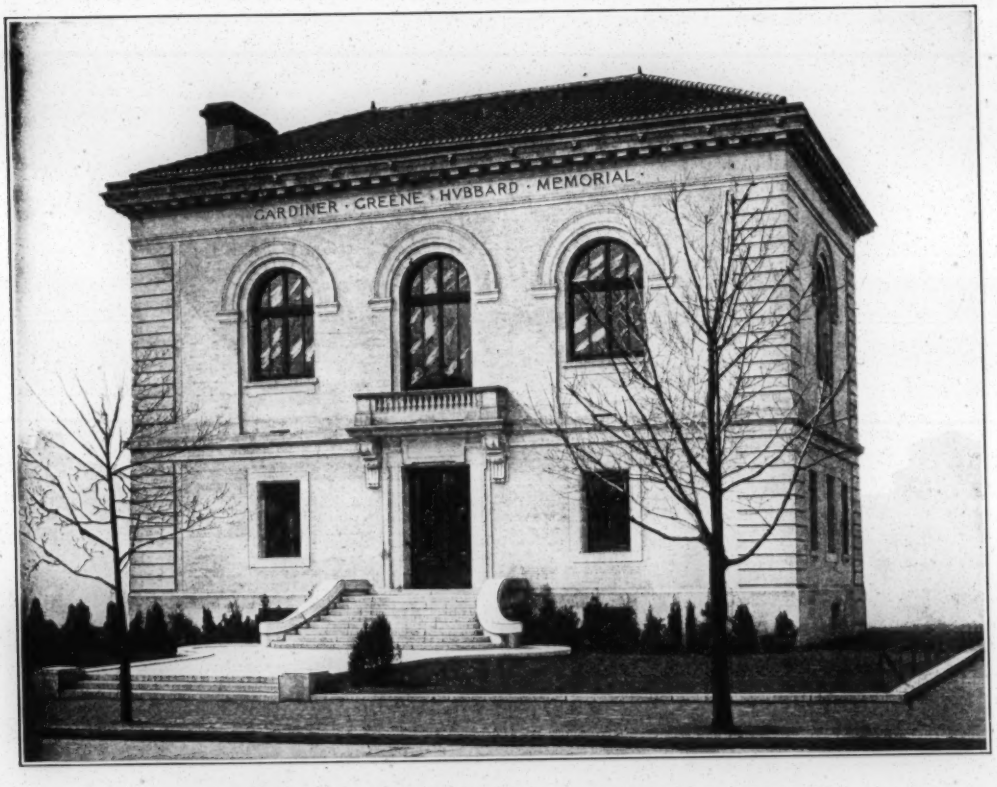

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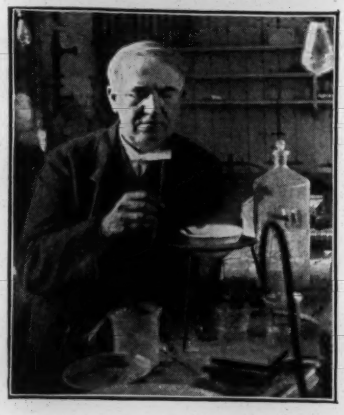

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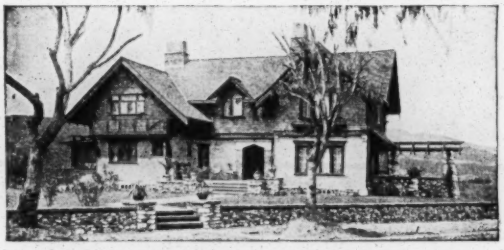

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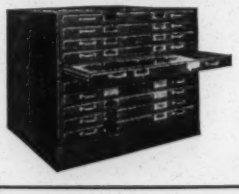

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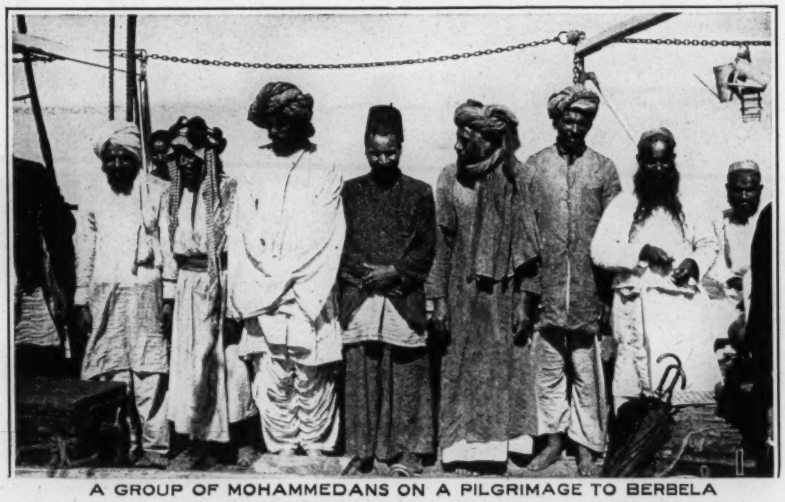

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